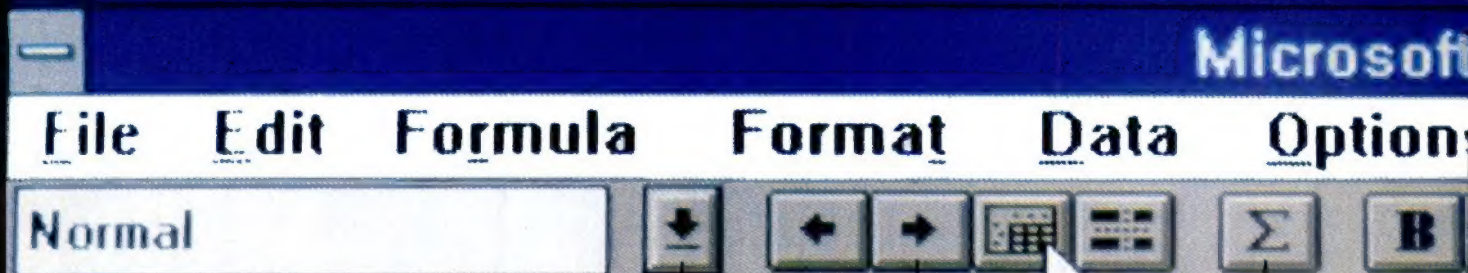






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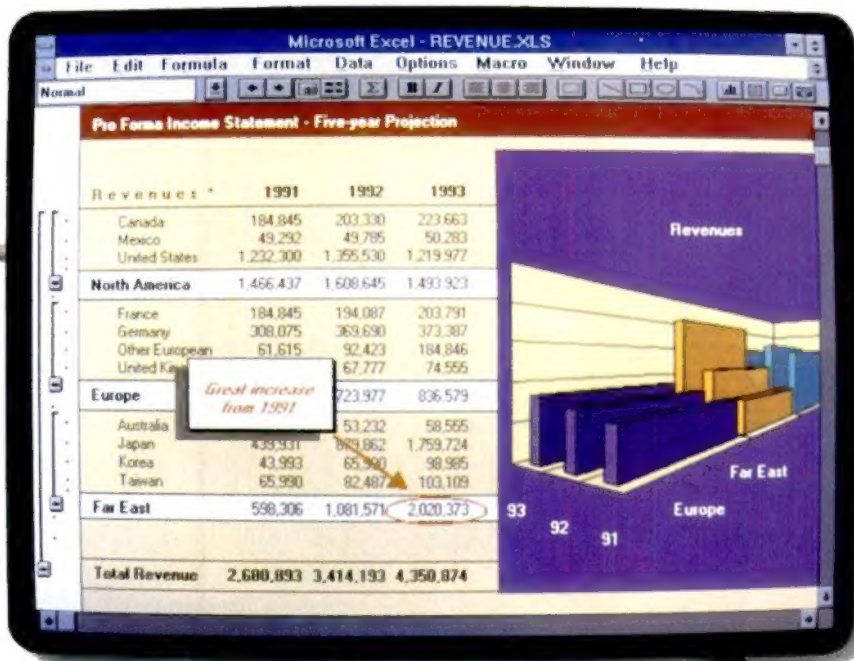
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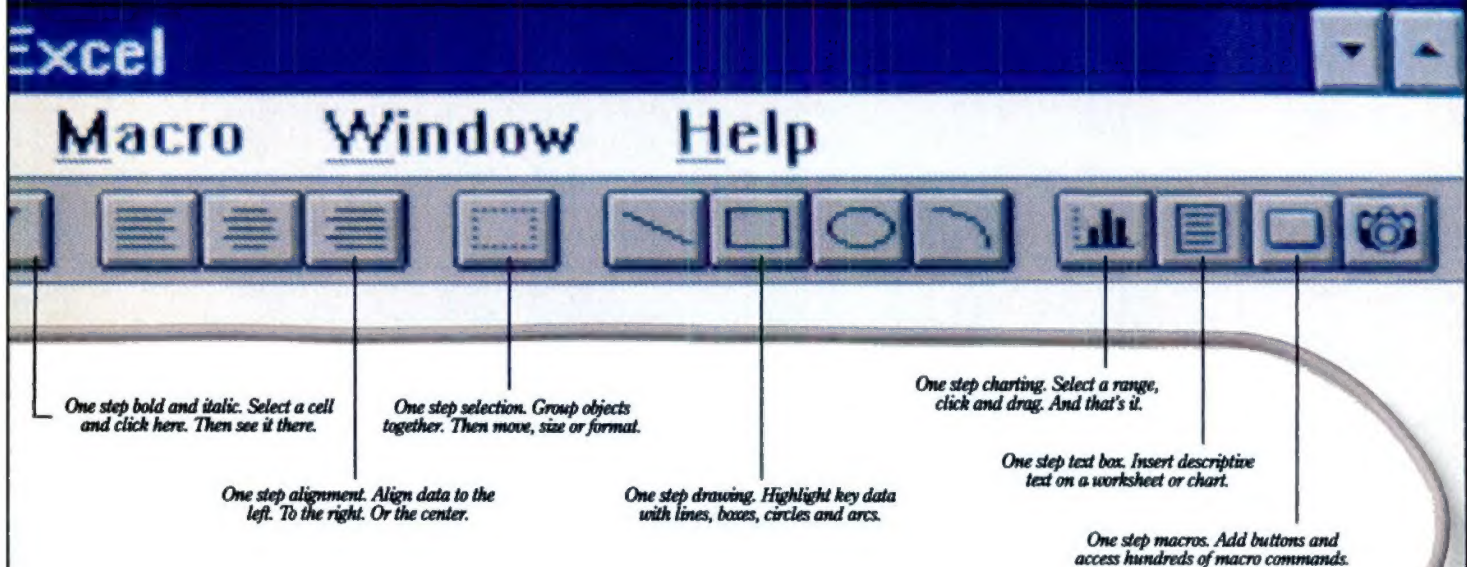
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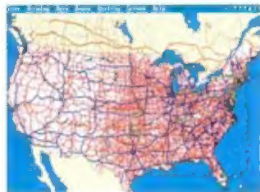
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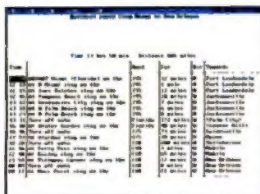
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Inside

The editorial reins at *PC Magazine* do not change hands often nor lightly. With this issue, Michael Miller becomes the fourth editor-in-chief in *PC Magazine*'s ten-year history. Miller is one of the few people in this business who is actually qualified for his job by education. His undergraduate degree is in computer science and he has a master's degree in journalism. More importantly, he brings a wealth of experience, from his early days on daily newspapers, then as West Coast bureau chief of *Popular Computing*, to his most recent experience, first as executive editor, then as editor, and finally as editor-in-chief of *Infoworld*.

Miller is relentlessly devoted to products, and his lucid "First Look" reviews are notable for their accuracy and for getting to the heart of each product's purpose. He built *Infoworld*'s product review operation into one of the most respected in the industry. Product sensibility is the ultimate skill required by *PC Magazine*, and Miller has it aplenty. His journalistic sensibilities are well honed too, and he'll be applying them to improving *PC Magazine*. In vendor and user communities alike, he's well regarded. In fact, as word of his appointment became known throughout the industry, our e-mail in-boxes were jammed with congratulatory messages.

Miller is equally devoted to his wife



and his year-old daughter, who are moving with him from the Bay Area's unvarying climes to the New York area, where the seasons are as individual and volatile as the cab drivers. The Millers are no strangers to emphatic weather, however, since they originally hail from Chicago.

Of his new assignment Miller says, "*PC Magazine* is the ultimate challenge. It has the biggest circulation, the biggest reviews, the meatiest productivity section, and the most dedicated readers. I'm looking forward to continuing to deliver the kind of coverage readers expect and making the changes that readers want."

Look for Miller to join the ranks of *PC Magazine* columnists in future issues, too. His favorite topic is new software, but you can count on him to have feisty yet well-founded positions on just about every aspect of products, the industry, the way products are used, and the way they're sold.

We're proud to have Michael Miller join the *PC Magazine* family. His contributions will be felt throughout the industry.—**Bill Machrone**
Bill Machrone has been appointed vice president of technology for Ziff-Davis Publishing Co., and he also heads up ZD Labs, a new corporate testing facility that will serve all Ziff-Davis publications. He remains publishing director of PC Magazine.



Michael Miller joins *PC Magazine* as editor-in-chief: "It's the ultimate challenge."

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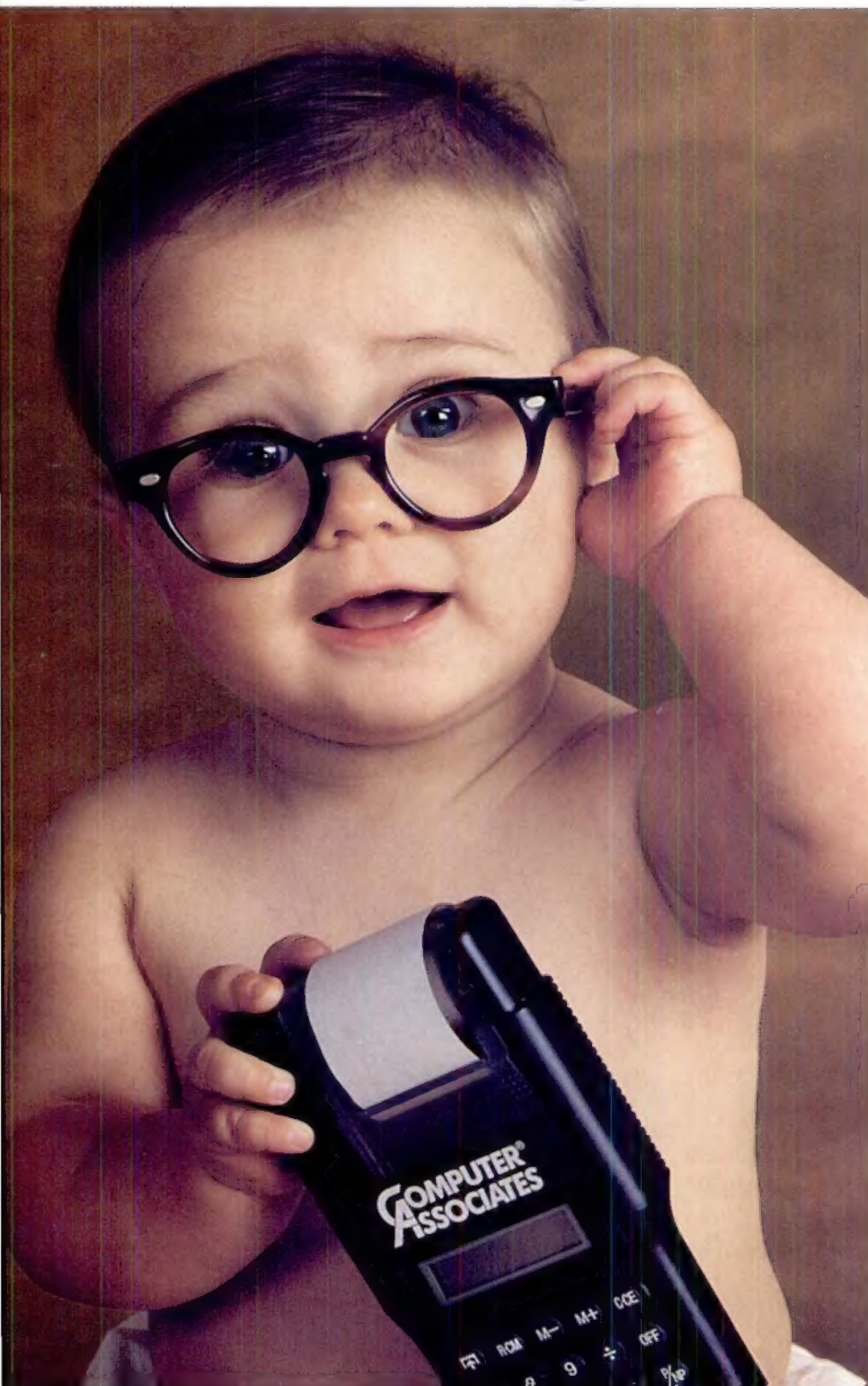
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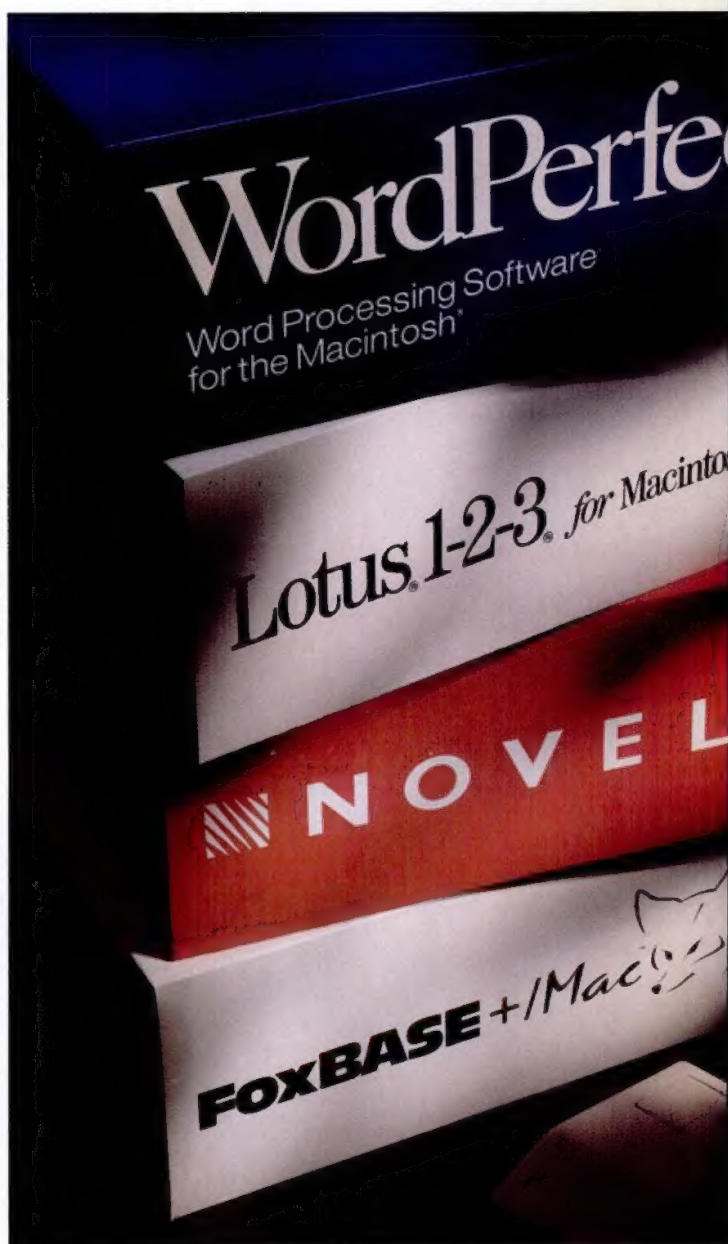
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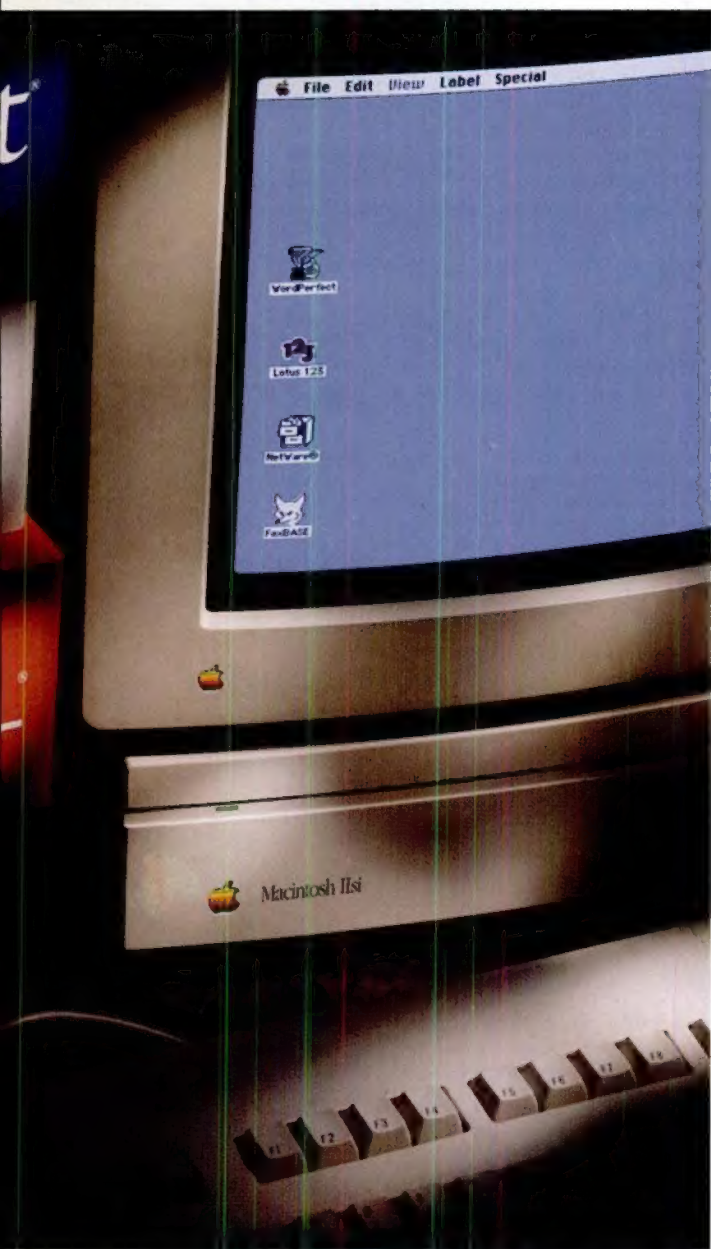
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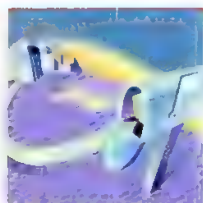
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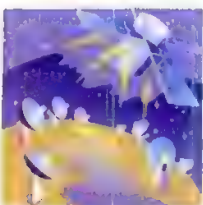
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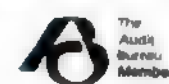
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PC MAGAZINE REVIEWS

Except where noted: All *PC Magazine* reviews are of currently available products. Comparative reviews are arranged alphabetically by product name for software, by company name for hardware. Software is free from copy protection. On benchmark test charts, shorter bars indicate faster products (less time to complete a task). Benchmark and performance tests are run on Compaq Deskpro 386/25s and 25es.

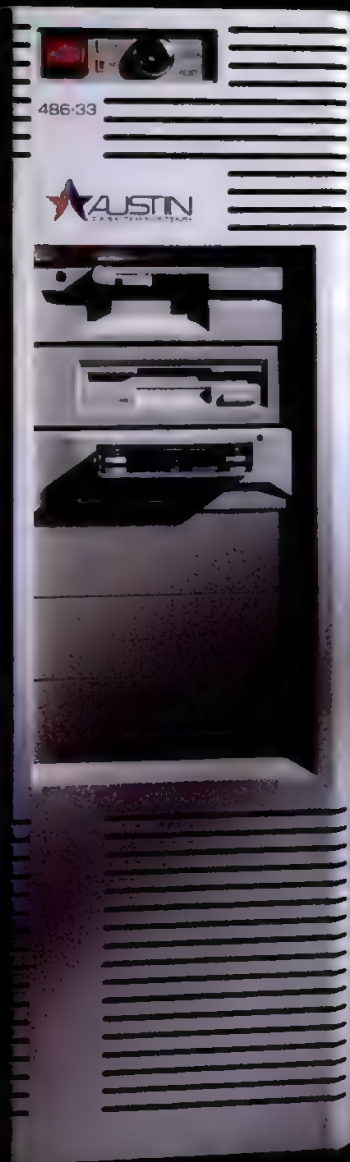


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AUSTIN 386/SX16 WINSTATION \$1790

Microprocessor: 386/SX running at 16MHz
Special Features: Pre-loaded with Microsoft Windows 3.0, MS-DOS 5.0 and a Microsoft mouse
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Memory: 2Mb RAM
Video: 14" non-interlaced 1024 x 768 VGA color monitor with 1 Mb VGA color video adaptor. Other options available. Call for details.



AUSTIN 386/SX20 WINSTATION \$1890

Microprocessor: 386/SX running at 20MHz
Special Features: Pre-loaded with Microsoft Windows 3.0, MS-DOS 5.0 and a Microsoft mouse
Storage: 40Mb IDE hard drive
Memory: 2Mb RAM
Video: 14" non-interlaced 1024 x 768 VGA color monitor with 1 Mb VGA color video adaptor. Other options available. Call for details.



AUSTIN 386/25 WINSTATION \$2090

Microprocessor: 386 running at 25MHz
Special Features: Pre-loaded with Microsoft Windows 3.0, MS-DOS 5.0 and a Microsoft mouse
Storage: 40Mb IDE hard drive
Memory: 7Mb RAM
Video: 14" non-interlaced 1024 x 768 VGA color monitor with 1 Mb VGA color video adaptor. Other options available. Call for details.



AUSTIN 386/33 WINSTATION \$2390

Microprocessor: 386 running at 33MHz
Special Features: 128K system cache. Pre-loaded with Microsoft Windows 3.0, MS-DOS 5.0 and a Microsoft mouse
Storage: 85Mb IDE hard drive
Memory: 2Mb RAM
Video: 14" non-interlaced 1024 x 768 VGA color monitor with 1 Mb VGA color video adaptor. Other options available. Call for details.



AUSTIN 486/25 WINSTATION \$3590

Microprocessor: Intel 486 running at 25MHz
Special Features: Internal 8K cache. Microsoft Windows 3.0, MS-DOS 5.0 and mouse.
Storage: 1.25Mb IDE hard drive with 32K cache
Memory: 4Mb RAM (expands to 32 Mb)
Video: 14" non-interlaced 1024 x 768 VGA color monitor with 1 Mb VGA color video adaptor. Other options available. Call for details.



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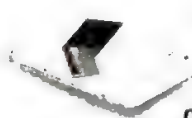
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MAXIMUM ON-LINE	3,745Mb	623Mb	85Mb
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Letters

DATA HAS NO WORTH

You can argue the fine points with John C. Dvorak ("Data Has No Worth," April 30, 1991), but not the conclusion. To sell CD-ROMs, prices must be cut. Deeply.

People may not be reasonable, but they aren't stupid, either. Why pay \$300 to \$1,000 for a little plastic data disk when a music CD that looks just like it costs only \$10 to \$25?

Bill Nelson
Simi Valley, California

I want to second Dvorak's comments on CD-ROM pricing. While the drives themselves need to come down in price before the medium really takes off, I agree that overpricing on the part of the publishers is the chief reason the CD-ROM format has fizzled so far.

For example, take the *Oxford English Dictionary*. I can buy the compact edition for about \$375 in a local bookstore, complete with a handy text-retrieval engine (a magnifying glass). The best street price I've seen for the CD-ROM version is about \$900. Given that it's *substantially cheaper* to produce the CD than the bound book, where is that \$500 or so going?

Vernon Shetley
Cambridge, Massachusetts

UNREASONABLE EXPECTATIONS?

I applaud Bill Machrone's column "Unreasonable Expectations?" (May 14, 1991). Everything Machrone said about older technology (both hardware and software) is correct. The industry must move ahead to stay alive, but in its wake is tons of great stuff—still useful today, if supported. I say, "Right on, Bill!"

Richard Hanson
Pleasant Hill, California

I can hardly believe what I read in Bill Machrone's May 14 column. While he laments the unavailability of service and technical support for the products of many defunct companies, he has erroneously included Eagle Computers on the list.



In fact, Wilkinson Micro has continually provided technical support, parts, and service for owners (and dealers) of Eagle computers since 1986. The technical support number is 714-895-1759, as it has been since 1984.

Allen L. Wilkinson
Wilkinson Micro
Irvine, California

Bill Machrone stated that PC Designs was no longer in business. This is not correct. PC Designs has maintained the 800 technical service number for customers continuously since 1985. Unlike some tech lines, PC Designs offers a live on-line technician to assist with a variety of solutions for customer problems.

Michael H. Freeman
Tulsa, Oklahoma

MARVELOUS MUMPS

I would like to thank both you and John C. Dvorak very much for helping to expose a very well-kept secret: the existence of the marvelous programming language called MUMPS! I have programmed in this language for almost ten years and

can attest to its ease and versatility.

Its database is the essence of efficiency. The File Manager feature makes it possible for even the novice to produce useful applications quickly. I can see why the COBOL people—and others—don't want the average person out there to know too much about it!

There are several MUMPS distributors out there, but I will put in a plug for Data-Tree (318 Bear Hill Rd., Waltham, MA 02154) for a reasonably priced, bugfree, well-supported MUMPS.

Julie Stephens
Western Springs, Illinois

WHO CREATED CHAOS?

Issue after issue, I continue to enjoy Dvorak's Inside Track column. However, in the April 30, 1991, installment, he incorrectly states that James Gleick developed the chaos theory.

James Gleick deserves credit for writing a book that brilliantly makes the chaos theory accessible to the general reader. Credit for development of this theory is shared by many scientists (Lorentz, Feigenbaum, Mandelbrot, and many others).

Arthur St. Hilaire
Bloomfield, Connecticut

TURN DOWN THE NOISE!

I bought a 386-based tower on the recommendation of a review in *PC Magazine*. The excitement of unpacking the boxes and plugging it all together was replaced by dread the moment I turned it on; it sounded like a damn jet plane taking off. After several hours of programming, my ears are ringing.

The noise level of computers is not a minor consideration! I'm looking forward to the day when computers become as quiet as refrigerators, and I'm hoping you'll begin printing noise-level ratings.

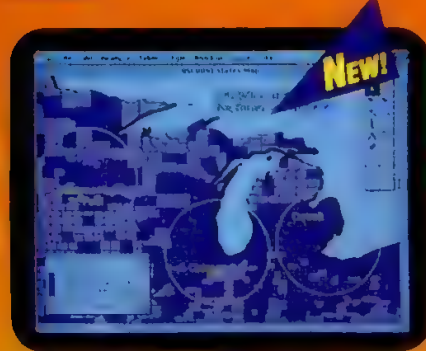
Dan Roberts
Sacramento, California

Let me add my voice to the clamor. Like Roger Freeman (Letters, May 14, 1991) I

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Letters

would love to see noise ratings in future PC reviews. Not only your readers, but also many of your mail-order advertisers, would benefit.

Bob Twilling
Bozeman, Montana

RECYCLING RHETORIC

Don't you *dare* degrade the quality of your magazine as a result of Svien's letter (Letters, May 14, 1991). Clearly, he sees no more worth in your publication than he does in a daily newspaper, as he regularly discards his issues on a quarterly basis.

I, on the other hand, (and I'm sure I'm not alone) keep *PC Magazine* forever, as I continue to find it a valuable reference over time. Your utilities, DOS tips, and the rest, don't lose their worth for quite a while. I also greatly appreciate the quality of your magazine when I thumb through old issues and the pages don't fall out.

Until technology can find a more efficient means of returning the earth's materials back to the earth in a truly environmentally safe manner, Svien's request is insubstantial.

Paul Capobianco
Columbia, Maryland

There is a growing demand in this country for just the type of slick glossy paper that your magazine is printed on; it is recycled into new newsprint.

My company consumes in excess of 60,000 tons per year of old magazines at our Oregon paper mills. We are currently purchasing old magazines from a recycler in the Minneapolis-St. Paul area. Svien's old copies of *PC Magazine* are a valuable raw material in the manufacture of new paper products.

John W. Lucini
Western Sales Manager
Smurfit Recycling Company
Oregon City, Oregon

MEA CULPA

In your April 30, 1991, review, "To the Limit: Caching the 386SX/20," there were a few inaccuracies about AST Research's Premium II 386SX/20.

The reviewer mistakenly confuses I/O bus architecture with the system's CUPID processor/memory enhancement. The Premium II is an ISA-based system; CUPID is an enhancement designed for easy

system upgrades. 4MB SIMMs are *not* a "rare device" any longer; they are widely available through third-party manufacturers, as well as directly from AST.

The reviewer also notes that the Premium II has a "proprietary" mounting arrangement for its 3.5-inch hard disk drive. However, no industry standards actually exist for mounting brackets. The bracket in the Premium II is capable of supporting two IDE hard disk drives and is easy and convenient to use.

One final point. The Premium II's per-

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formance on the benchmark tests is equal to or exceeds that of the leader.

Larry Fortmuller
Director of Product Marketing
AST Research
Irvine, California



CUPID is an AST extension to the ISA bus design, allowing upgradable processors while retaining compatibility with industry-standard expansion cards. *PC Magazine's* description of CUPID as "proprietary . . . a maverick design," while technically correct, was also misleading. The article incorrectly stated several features. The AST Premium II 386SX/20 has five drive bays, not four. The power supply is 145 watts, not 220.—Ed.

RAPID OR NOT?

While we were pleased at having *Rapid Transfer Easy* included in your roundup of file-transfer products (March 12, 1991), it is unfortunate for your readers that the benchmark test used was unintentionally biased in favor of parallel mode products, and specifically distorted the performance characteristics of both serial and parallel mode transfers in practical, real-life applications.

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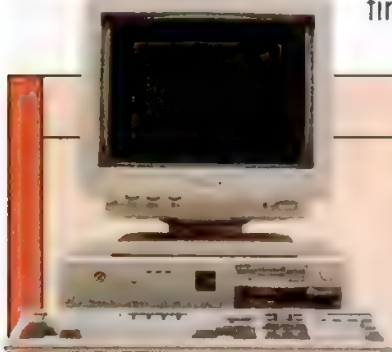
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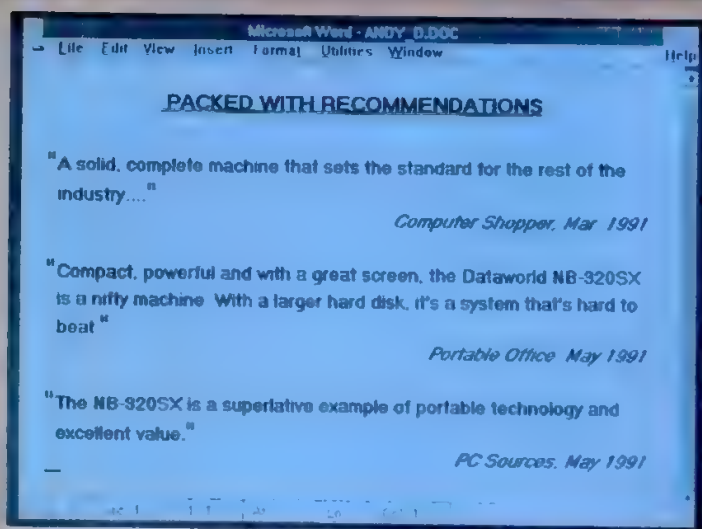
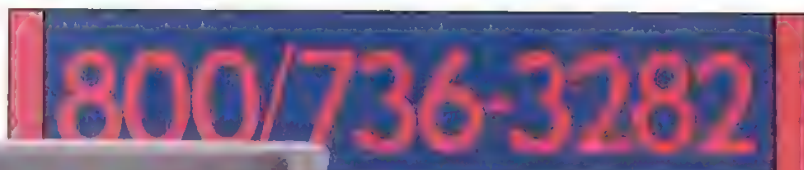
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And they weren't just any guys, either.

They were a group of editors from *PC Magazine*, and in their February 26th, 1991 issue, they had some

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awfully nice things to say about DCA's IRMA™ WorkStation for Windows.

Some comments:

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Letters

You state "Using parallel connections to hook up two PCs will always provide faster throughput than serial connections." This conclusion is not only misleading; it biases your readers against serial-mode products. In many practical transfer applications, *Rapid Transfer Easy* is the fastest way to achieve file-transfer throughput.

John R. Segner
President
Intertech Marketing
Raleigh, North Carolina



The old saw says "Never say 'never'!" and the statement that parallel connections will "always" provide faster throughput than serial connections can certainly be proven wrong.—Ed.

THE MORE THINGS CHANGE...

I found a forgotten copy of *PC Magazine* (January 27, 1987) on a dusty bookshelf last week and I thought I would see what was "new." What really caught my eye were three letters admiring/lambasting John C. Dvorak and the observation that *Windows 1.x* was "the cat's meow." The more things change...

Clyde Metz
Mt. Pleasant, South Carolina

BEATING A DEAD HORSE

Please, no more articles on the *Windows* versus *OS/2* debate! Stop wasting valuable space on a dead issue! When will William Zachmann admit that *Windows* is the dominant GUI environment ("Windows, Now and Forever?" May 28, 1991)?

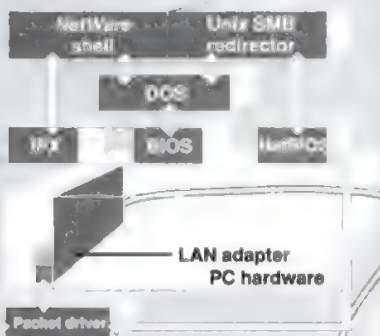
Mr. Zachmann refers to lagging sales figures for *Windows* apps. Once the big three (*Lotus 1-2-3*, *dBASE*, *WordPerfect*) have *Windows* versions and you throw in a couple of solid utilities (Central Point and Symantec—where are you guys?), then you will see a significant upturn in sales.

As for *OS/2*, it will only become a major environment when Microsoft is ready to make it so. IBM does not have the software clout or consumer confidence to establish an environment by itself. Mr. Zachmann describes *OS/2* as an "imminent reality;" that's nice, but we already have a product that we can use right now—*Windows 3.0*.

Jeff Snyder
Brooklyn, New York

CORRECTIONS & AMPLIFICATIONS

This is the corrected diagram for the "Making Simultaneous Connections" sidebar in "Unix Services for DOS-Based PCs" (May 28, 1991).



The correct phone numbers for *Ingres*, Version 5.0 from ASK Computer Systems, Ingres Products Division ("Database Clout!" May 28, 1991) are 800-446-4737, 415-769-1400.

In New and Improved Briefs, (May 28, 1991, p. 60) the 800 number for the student edition of *dBASE IV* should have read 800-527-5210. Also, in the same column, the cost of upgrading from Version 1.0 to Version 1.5 of *FaceLift* is \$24.95, and the phone number is 800-522-3668.

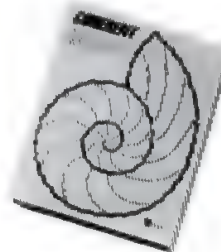
In the "Asynchronous Communications Software: Improving Information Access," cover story (April 30, 1991), the features table on pages 122 and 123 should have stated that *Crosstalk Mk.4* can edit multiple files, and that *Professional YAM* does not contain a built-in text editor.

In the same article, we should have stated that *COM-AND* does work with hardware flow control. Three separate sources corroborated the results that led us to believe the program was flawed in a way it was not.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments, complaints, insights, and suggestions. Please send them to Letters, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access information). All letters become the property of *PC Magazine* and are subject to editing.

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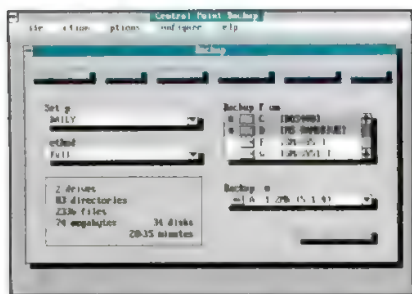


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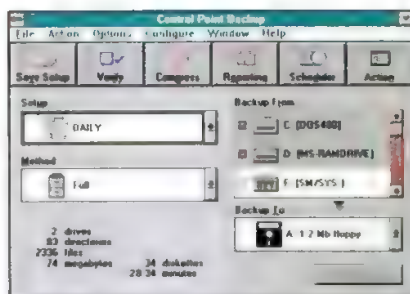
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by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Microsoft Calls for a Truce In Its War on PostScript

Last year, it seemed like a war was brewing for the page description language (PDL) market. Microsoft acquired a PostScript clone that it said would become the core of TrueImage, a PDL that would bury PostScript with its sheer power.

This year, Microsoft is taking a more conciliatory tone. The apparent reason is that companies that made the switch to PostScript in years past aren't interested in switching again.

So, without abandoning TrueImage, Microsoft has decided to let someone else do the missionary work. It has created a licensing project with the unlikely name of *TrueImage Mentor Program*. Loosely translated, that means *reseller*.

LaserMaster, the company

that built a reputation for fast printer controllers and also engaged in its own war against Adobe, is the first company to sign up as a TrueImage evangelist. This means that LaserMaster, not Microsoft, will work with vendors who want to develop TrueImage applications.

LaserMaster is combining TrueImage with its "Turbores" printer engine. Consequently, a software vendor who wants to take that LaserMaster engine one step further (adding color, for instance), will get support from LaserMaster, not Microsoft. And it will be LaserMaster who licenses the extension, not Microsoft.

For now, TrueImage and its font manager, *TrueType*, are destined to be the printing stan-

dards for *Windows*, and they should first be available in *Windows 3.1* (expected before the end of the year).

And because *TrueType* will be able to manage Adobe's *Type 1* fonts and will coexist with *Adobe Type Manager* in *Windows 3.1*, it seems like the major market shift that Microsoft originally promised for TrueImage will not materialize.

TrueImage, with its unique image-scaling technology, seems destined to be just one of the programming techniques used inside *Windows*—and inside whatever future operating systems Microsoft decides to use it in.

If TrueImage turns out to be as good as Microsoft believes it is, the technology may prove to

be a key factor in helping *Windows* wage the operating system war it finds itself in with IBM's *OS/2*—and the war a future version of *Windows* may have to wage against the combined work of IBM and Apple. If the Apple-IBM venture succeeds, *Windows* will need to run on the RS6000 and other processors that may emerge.

In fact, the prospect of competing with a combined IBM and Apple operating system is likely to prompt Microsoft into looking for more ways to cooperate with existing standards, rather than rally around new ones.

But for now at least, Microsoft is avoiding the risk of antagonizing companies who've already invested in PostScript.

CONTINUES ON PAGE 30

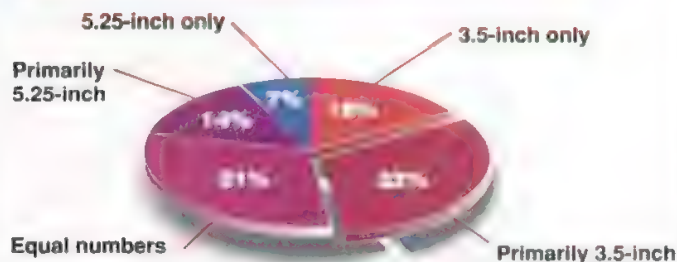


SURVEY: FLOPPY DISK CHOICES

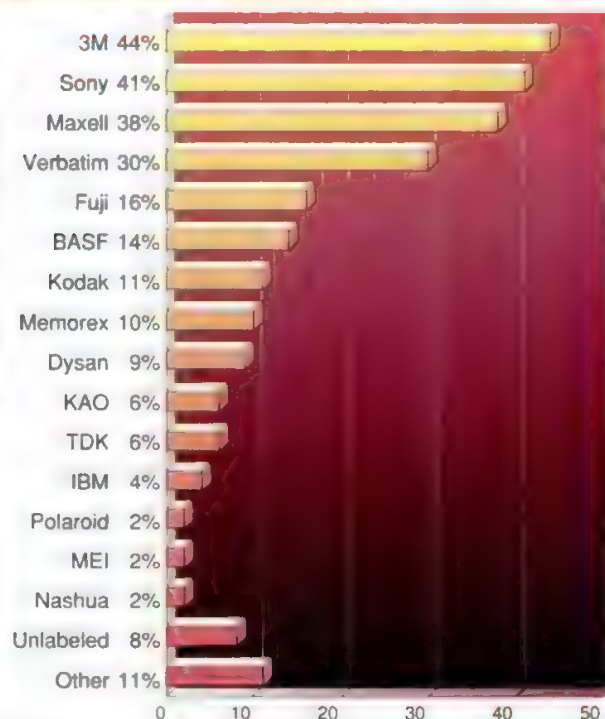
It may not be today's most burning issue, but we were curious to know which floppy disks people are choosing.

More than 1,100 people responded to our PC MagNet questionnaire. The results indicate that the shift from 5.25-inch to 3.5-inch disks continues slowly.

What size floppy disks have you purchased in the last 12 months?



Which brand of floppy disks have you purchased within the last 12 months?



Pipeline

CONTINUED FROM PAGE 29

NEC's NID Will Generate Full-Motion Video on CDs

Everyone's talking about CDs and multimedia, but most everyone's willing to let Microsoft take the lead.

IBM and Intel are notable exceptions, and now NEC has announced that it's at work on its own new technology.

NEC's NID (New Interactive Display) incorporates 100:1 data compression for displaying stereo-quality sound and real-time video with special effects. It will conform to JPEG and MPEG, the leading international formats for compressing still and full-motion video, respectively.

PC-compatible authoring kits will be introduced first with the NEC TurboGrafix-16 system as the first user platform. Specifications for display on a PC are down the road.

Prodigy Reaches a Landmark

After three years of on-line operation, Prodigy has announced that 1 million users are currently registered.

In compiling that number, the Sears-IBM joint venture includes every active participant and acknowledges that the total number of dues-paying households is somewhat less, probably in the range of 600,000.

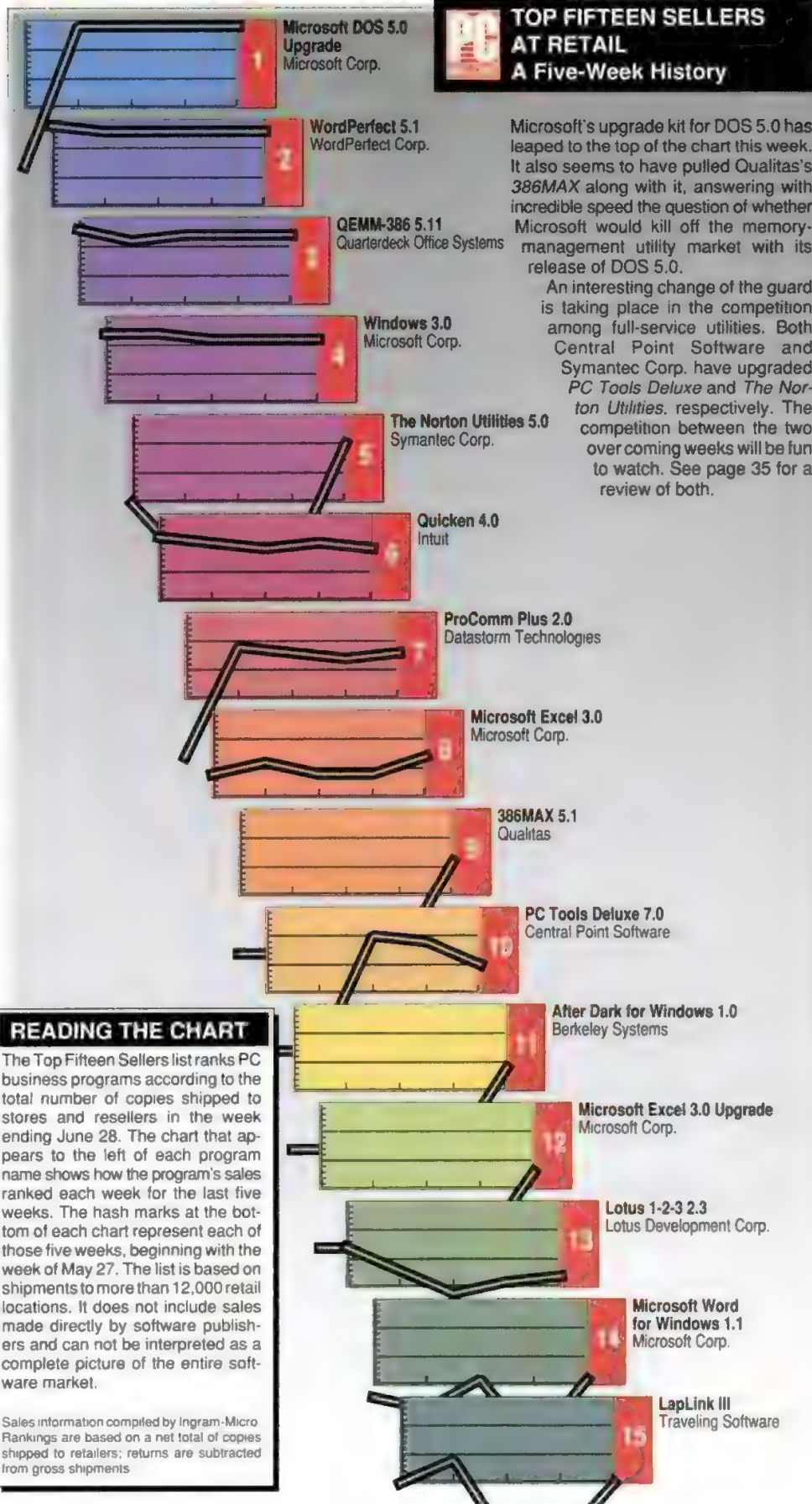
Prodigy became a national service last September after two years of regional tests.

Borland and Ashton-Tate Agree to Merge Through a Stock Swap

At deadline, it was learned that Ashton-Tate and Borland agreed in principle to merge.

Both boards of directors already have agreed to the terms of the agreement.

With competing products in the two companies' lineups, the merger raises a whole slew of questions for the future of PC software. Next issue, a full report will appear.



Once again, editors rave about the Tangent 486.

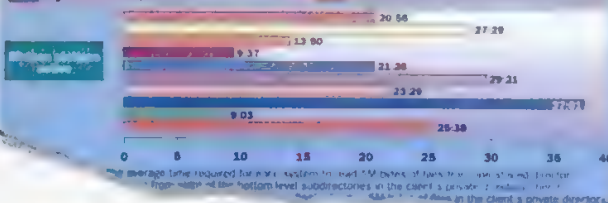
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PC WEEK

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CSG Laboratories MacSys 486TE/33
Dell Computer System 433TE
Hewlett Packard Net-32 486i
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The Network Connection Triumph TRX 486/33



"A consistently strong performer across all tests, the Tangent model 433e stands out in this group." PC Magazine April 16, 1991



April 16, 1991
Tangent 433e

PC Magazine, April 16, 1991

TANGENT COMPUTER INC.

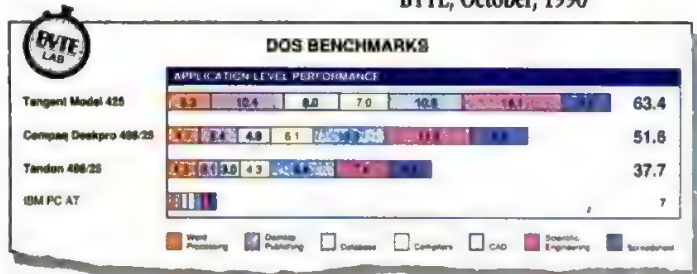
Tangent Model 433e

by Bill O'Brien

Tangent Computer's foray into the realm of the EISA bus is represented by an investment-quality machine.

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BYTE, October, 1990



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CIRCLE 165 ON READER SERVICE CARD

First Looks

Hands-on Reviews of the Latest Products

IBM Strengthens Middle of PS/2 Line, Adds Modest Innovations

Three 20-MHz PS/2s, 2.88MB Floppy, and Touch-Screen Display Are Part of IBM's Effort to Assert Leadership

ANALYSIS
by Gus Vendler

It became a public secret this spring: IBM's top management wants to see a more aggressive IBM. After that, signs of a new attitude began to appear from every corner, as IBM managers engaged in an unprecedented level of deal making.

IBM convinced Borland to create an OS/2 2.0-specific version of *ObjectVision*, which IBM says it will market. Then IBM talked Lotus into developing a version of *Notes* for *ObjectVision*.

And then it engaged in highly publicized negotiations with Apple that have shaken the PC development community to its very roots.

The promise of a unified IBM-Apple operating system will take years to fulfill and



there's no reason to change immediate buying plans until more-concrete details emerge. For now, all we know is that an operating system with the Mac's spirit will work on pro-

cessors with the RS/6000's power—if the Apple and IBM teams can work together.

None of this helps IBM's PS/2 line, which has started to look old. And so the PS/2 mar-

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keters took modest steps toward revitalizing that product line. Three new systems were introduced, along with a slate of innovative peripherals.

In spite of what the Apple deal may suggest, IBM's PS/2 line is in no danger of moving too far ahead of the technology curve. In fact, these new machines may need to catch up: The Models 35, 40, and 57 are all 20-MHz 386SXs, a technology so prevalent last November that a *PC Magazine* roundup included 40 machines.

IBM recognizes that it's in a marketing war, so these machines

CONTINUES ON PAGE 36

PC Tools 7.0 and Norton 6.0 Begin Where DOS 5.0 Ends

HANDS ON
by Edward Mendelson

When a new DOS arrives, updated versions of the major DOS utility packages can't be far behind. Within days of DOS 5.0's release, Symantec Corp. released *The Norton Utilities*, Version 6.0 (\$179, upgrade \$39), and Central Point Software released its \$179 *PC Tools*, Version 7.0 (upgrade \$49).

Both integrate smoothly

with the new file safety and memory management features of DOS 5.0, and both add features that go beyond previous DOS utilities.

First comparisons of features and performance show that *Norton* remains preeminent in data recovery and disk exploration, and adds a replacement for COMMAND.COM that eliminates many of the shortcomings of command line DOS.

Meanwhile, *PC Tools*—with its backup program, file

manager, and remote-control program, in addition to data-recovery programs—remains unparalleled in its range and variety of functions.

No other single DOS product boasts as many features and conveniences as *PC Tools*. But if you ever need to probe into the depths of a damaged disk for lost data, you'll want a copy of *Norton* in easy reach.

In their previous versions, both packages tended to favor a menu-driven interface over the command line often preferred by expert users. Both packages now can be used almost as easily from each, and *Norton* has re-

stored some command line utilities from Version 4.5 that were dropped in 5.0.

PC Tools' menus are less cluttered than before, and its command line options are notably rich. *Norton's* menus remain mostly quick and easy, with some glaring flaws. For example, you can't simply type in a list of drives for *Norton's* file finder to search but have to tab or mouse your way around a menu of check boxes—and you can't even specify a list of drives on the command line.

Each new version of *PC Tools* adds a half-dozen new

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PHOTOGRAPHY: THOM O'CONNOR

First Looks

IBM PS/2

CONTINUED FROM PAGE 35

chines are aggressively priced for IBM. The machines are hundreds of dollars—and in some cases more than a thousand—more expensive than comparable models from established competitors, but they have low enough list prices that dealers will be able to offer discounts within striking distance of some of IBM's major rivals.

And two of the three represent a significant retrenchment: Models 35 and 40 both use an ISA rather than an MCA bus.

Within the group there's a clear pecking order: Model 35 is the low-end entry to 32-bit computing, Model 40 is the mid-range with lots of expansion but no real innovation, and Model 57 is the technology showcase (reviews follow).

The new machines are only one part of a broad range of innovations for the PS/2 line.

The most significant is a higher-density format for 3.5-inch floppy disks. The new 2.88MB drive is standard on the Model 57 SX and is available as a \$325 option for the other new PS/2s. It's compatible with both 720K and 1.44MB 3.5-inch formats and will require either OS/2 1.3 or DOS 5.0.

The other peripheral with the most potential to influence standards is the 128MB Rewritable Optical Drive. With a list price of \$1,795, the SCSI device may catch on not as an archiving medium (for which it is modestly suited), but as a distribution system for applications that need massive storage, such as multimedia (see review, page 37).

The drive's 66-millisecond access time puts it at a disadvantage to removable disk cartridges but compares favorably with CD-ROM drive performance. The drive also comes with a suggestion from IBM that its ability to create read-only cartridges makes it an ideal CD-authoring device. That suggestion sounds good only if you feel confident IBM will some day produce a low-cost read-only device, since the drive's

BENCHMARK TESTS: IBM PS/2 MODELS 35 SX, 40 SX, AND 57 SX

IBM's noncached 20-MHz 386SXs could not match the processor and memory performance of the Compaq Deskpro 386s/20. However, IBM's 40MB and 80MB 17-millisecond drives with integrated controllers in the Models 35 and 40—and the 160MB 16-ms. SCSI drive in the Model 57—significantly outperformed Compaq's 60MB 19-ms. IDE drive.

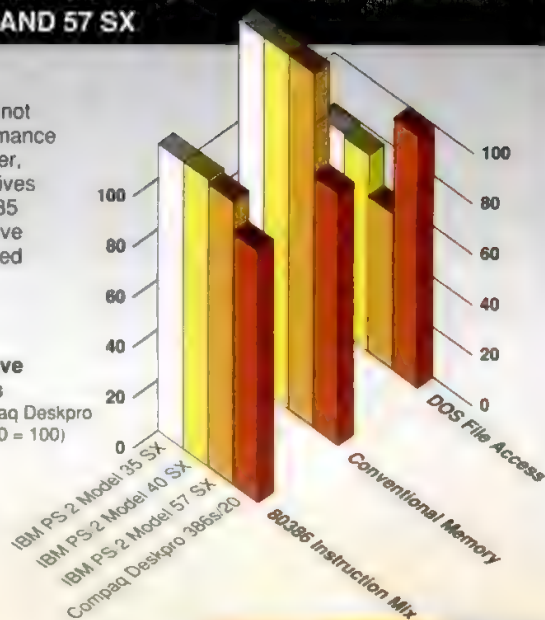
■ The **Instruction Mix** benchmark test times a series of tasks specific to the processor. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.

■ The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower times can indicate the presence of memory wait states or memory chips rated at relatively slow access speeds.

■ The **DOS File Access** score is the sum of the small-record and large-record DOS File Access benchmark test times. Each test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. No software cache is employed.

Relative Times

(Compaq Deskpro 386s/20 = 100)



Performance Times (Times given in seconds)	80386 Instruction Mix	Conven- tional Memory	DOS File Access
IBM PS/2 Model 35 SX	3.54	0.66	52.17
IBM PS/2 Model 40 SX	3.54	0.66	51.31
IBM PS/2 Model 57 SX	3.49	0.66	40.56
Compaq Deskpro 386s/20	3.11	0.47	65.73

128MB format is not compatible with High Sierra standards.

IBM demonstrates the drive connected to a new touch-screen monitor, the PS/2 Touch Display 8516, in an effort to establish the two as interactive-training products. (Both are included in separate multimedia kits with adapters from the Audio Visual Connection line.)

The touch screen is markedly better than earlier attempts, partly because it runs on ordinary VGA or XGA adapters and will have drivers for OS/2. It's no threat to the mouse but it does add a new dimension to point-of-sale marketing (see review, page 38).

The last aspect of IBM's attempt to show technology leadership is an announced 50-MHz 486 processor-card upgrade for the Models 90 and 95. The device wasn't ready in time to be reviewed in this issue, which isn't too bad of a reflection on IBM since none of the companies who've recently announced 50-MHz 486 PCs were able to deliver products by press time.

Like all significant IBM announcements, there was a flurry of changes to existing products.

Math coprocessors from 10 MHz (80287s) to 16 MHz (80387s), and expanded memory expansion kits were discontinued. New 8MB memory kits were introduced (\$2,195 at 80 nanoseconds, and \$1,995 at 70 ns.). And the Personal Communications/3270 was enhanced to support Ethernet and Windows.

A new SCSI 2.3-gigabyte tape drive (\$6,915) was unveiled, and SCSI was made standard on the Model 57.

Finally, IBM announced that it will sell DOS 5.0 in essentially the same form as Microsoft's DOS; the only significant differences are support for the new 2.88MB floppy disk and the 128MB optical drive.

While IBM representatives unofficially acknowledge that IBM's DOS 5.0 will run on most other vendors' systems, IBM will not officially support people who run the operating system on non-IBM computers.

Some things never change. ■

IBM PS/2 Model 35 SX

HANDS ON
by Matthew J. Ross

The IBM PS/2 Model 35 SX is IBM's low-cost, small-sized entry to 386 computing. Like the Model 40 SX, the Model 35 features an ISA bus and accepts three full-length AT-bus expansion boards.

The Model 35's small-footprint, low-profile case draws immediate comparisons to the Compaq Deskpro N line, and is highly suited as a diskless LAN workstation. (IBM offers such a configuration, the \$2,695 Model 35 LS—complete with an IBM 16/4 Token-Ring adapter. IBM plans to provide an Ethernet model in the future.)

The \$2,525 Model 35 SX comes with a 40MB IDE hard disk. IBM also offers a \$1,995 floppy disk-only unit. These prices do not include a monitor or operating system, and all systems start with 2MB of RAM

standard.

At 4.5 by 14.25 by 15.5 inches (HWD), it's slightly taller than Compaq's 3.8-inch-high N line. The two systems share the same basic footprint size, although the Model 35 accepts two 5.25-inch devices to Compaq's one, and has room for an extra expansion slot.

The Model 35 is roughly \$500 more than a comparably configured Deskpro 386N, but Compaq uses a 16-MHz 386SX chip in its system; the Model 35 is a 20-MHz 386SX.

Inside, the Model 35 features a baby-sized 8.5- by 11-inch motherboard similar to the Model 40's. A 16-bit VGA chip that carries both a Texas Instruments and IBM label is built into the system board, as are the serial, parallel, mouse, and keyboard ports.

Like the Model 40 and 57, the expansion bus extends vertically from the motherboard. I/O cards are installed horizontally, parallel to the motherboard. Three SIMM banks offer expansion in 1-, 2-, 4-, and 8MB increments up to 16MB.

The Model 35's two half-height, 5.25-inch drive bays are externally accessible for removable media. A high-density 3.5-inch floppy disk drive sits in the upper bay. This can be removed in favor of IBM's new 2.88MB extra high-density unit.

The 80MB disk that is used in the Model 40 is also offered as an option; both it and the 40MB unit evaluated in PC Magazine Labs are IDE hard disks featuring a 32K buffer. Surprisingly, the disks are manufactured by Maxtor, and clearly labeled that way.

Rounding out the internal workings is a 118-watt power supply that features a manual switch at the rear of the case to toggle between 115- and 230-volt input. The unit also contains an auto-sensing circuit, according to IBM.

Overall, the Model 35 is a step forward for IBM. It still costs more than most SXs, but with a list price of \$2,525, the 35 SX is likely to be discounted to a very reasonable price. The Model 35 SX gives the PS/2 line an entry-level or LAN workstation that makes sense in 1991. ■

IBM PS/2 Model 40 SX

The IBM PS/2 Model 40 SX is a dead ringer for its 20-MHz 386SX sibling, the Model 57. Looks are deceiving however, because inside its case, the Model 40 holds five 16-bit ISA-bus slots, not the usual MCA you expect from IBM. And, in fact, the machine bears more in common with the lower-priced Model 35 SX.

With four half-height drive bays (three are 5.25-inch), five open expansion slots, and a 197-watt power supply, the Models 40 and 57 SX offer more internal expansion than any IBM desktop since the PC-AT. The Model 40 SX comes in three basic configurations: \$2,395 buys you a system with 2MB of RAM and a 1.44MB floppy disk drive; \$2,925 is the price with a 40MB IDE hard disk; and an 80MB disk raises the system cost to \$3,195.

Inside the Model 40 SX, a compact 8.5- by 11-inch motherboard holds the Intel 20-MHz 386SX, a 387SX coprocessor socket, and three SIMM banks for system memory expandable to 16MB. A 16-bit IBM/Texas Instruments VGA controller chip is also integrated onto the system board, as are serial, parallel, PS/2 mouse, and keyboard ports (one of each).

Unlike the 16-millisecond IBM-built SCSI hard disk found in the Micro Channel 57 SX, both the Model 35 SX and 40 SX feature Maxtor IDE hard disks that are rated at 17 ms.

Sandwiched between the Model 35 and Model 57, the Model 40 provides compatibility with the ISA boards in the lower-end Model 35, and has as much expansion potential as the Model 57. But it falls short of the powerful features introduced to the PS/2 line by the high-end Model 57. ■

IBM PS/2 Model 57 SX

A close look reveals that IBM has saved its best new features for the Micro Channel-based \$4,195 PS/2 Model 57 SX. The 20-MHz 386SX boasts four features that its AT brother, the

Model 40, cannot match.

The most dramatic difference is a new 2.88MB floppy disk drive, which comes standard. It's compatible with 720K and 1.44MB 3.5-inch disks and is available only as an option for the other new PS/2 SXs. The drive requires Extra-High Density disks (ED), which have an unformatted capacity of 4MB and needs either DOS 5.0 or OS/2 1.3 to run.

The Model 57 SX also features an embedded SCSI-I controller built into the motherboard. The system's fast 16-millisecond 160MB hard disk runs off this controller, and so can six other SCSI devices; a port on the back of the system connects external devices.

Even though the machine uses the older SCSI format, its hard disk proved to be much faster on the PC Magazine Labs benchmark tests than the IDE drives in the 35 and 40 SXs.

Other unique features are support for IBM's MCA-specific extended graphics array (XGA) video technology, and parallel and serial ports that use a special DMA channel; IBM says that OS/2 2.0 (due out later this year) will utilize this feature for uninterrupted high-speed printing and communications.

As on the other systems, IBM includes 16-bit VGA on the systemboard. There are two

empty sockets on-board for additional video memory, and one slot with a connector for an XGA adapter upgrade. The Model 57 is the only new model that can run XGA, because this video standard requires MCA bus-mastering.

In other respects, the Model 57 SX is nearly the same as the Model 40. It uses the same 6.5- by 17.4- by 15.5-inch (HWD) outer case, and therefore has the same basic internal expansion. There are five free expansion slots that extend perpendicularly from the motherboard. Like the 40 SX, it has four storage bays; two remain free and can accept external media.

Among these three new models, IBM's logic is clear: You can have the ISA bus if you want, but IBM will save its best technology for Micro Channel-based machines. ■

List Price: IBM PS/2 Model 35 SX, with 2MB RAM, 40MB hard disk, VGA, \$2,525.

CIRCLE 710 ON READER SERVICE CARD

List Price: IBM PS/2 Model 40 SX, with 2MB RAM, 80MB hard disk, VGA, \$3,195.

CIRCLE 711 ON READER SERVICE CARD

List Price: IBM PS/2 Model 57 SX, with 2MB RAM, 160MB hard disk, 2.88MB floppy disk drive, VGA, \$4,195. IBM Corp., Old Orchard Rd., Armonk, NY 10605; 800-426-2468.

CIRCLE 712 ON READER SERVICE CARD

IBM's Compact Drive Makes the Cost Of Optical Storage More Practical



First shown last fall and now announced as a real product, IBM's 3.5-inch Rewritable Optical Drive may well do for magneto-optical (MO) disks what Hewlett-Packard did for laser printers: Move the technology into mainstream PC computing.

With a list price of \$1,795 for the drive and software to run it (in DOS 4.0 and 5.0 and OS/2 1.30.1), plus \$70 per 128MB disk, the unit slashes prices for optical drives nearly in half.

Alas, the real price is likely to be higher. Add the external SCSI enclosure, as tested, and

the price jumps to \$2,375. But you can install the drive internally in a half-height drive bay in most PS/2 MCA models. For some older models, add \$29 for a mounting kit. Most will need to add in the cost of a 16-bit SCSI adapter (\$495), or a 32-bit version (\$995).

Certainly the most impressive aspect of this technology is the 128MB disk itself. Slightly smaller than a stack of two 3.5-inch floppies, this high-capacity, removable, and, above all, compact storage option is tailor-made for large data files—for graphics, desktop publishing, or the blossoming field of multi-

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First Looks

Optical Drive

CONTINUED FROM PAGE 37

media. Removability also makes the drive a good choice for those who want to lock their data in a safe each night.

In addition to rewritable disks, the IBM drive can read 122MB 3.5-inch O-ROMs (Optical ROMs). These are similar to CD-ROMs in that they are a read-only publishing medium. However, they hold far less data (CD-ROMs hold about 680MB) and they are no more compatible with CD-ROMs than a Beta-max is with a VHS recorder.

If you think of MO disks as very high-capacity, fast floppy disks, you won't be far off. DOS 4.0 and 5.0 treat the disks as floppies both for formatting and for tracking their removal from the drive. Formatting takes about 20 minutes. PC Magazine Labs' disk tests put the drive in the same class as the slower 5.25-inch MO drives that we've tested, far slower than a hard disk.

The drive is SCSI-2 compatible, so in theory you ought to be able to put it in any system with a SCSI interface. More interesting is that the drive follows the new ISO and ANSI physical format standard for 3.5-inch media, so the disk itself should work with other manufacturers' drives.

Sony, for example, which has the lion's share of the 5.25-inch MO drive market, has just

announced its own 3.5-inch drive. Sony's drive is also compatible with the new ISO and ANSI standards for MO and O-ROM disks.

At this writing, the drives are not available to end users, but they will be shortly. And Sony says that their disks will be fully interchangeable between Sony and IBM drives.

IBM's drive, in short, is a harbinger of things to come. And even if you don't need one now, you may find that MO drives will soon be as indispensable as a hard disk. ■



FACT FILE

IBM PS/2 3.5-inch Rewritable Optical Drive

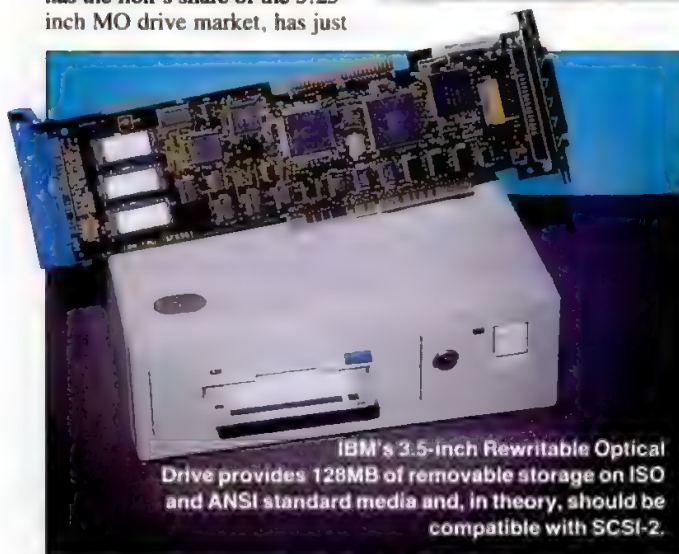
IBM Corp., Old Orchard Rd., Armonk, NY 10605; 800-426-2468.

List Price: Drive with device drivers for DOS 4.0, DOS 5.0, OS/2 1.30.1, \$1,795; external SCSI enclosure, \$360; cable with active terminator, \$220; one 128MB rewritable optical cartridge, \$70; 16-bit SCSI adapter, \$495.

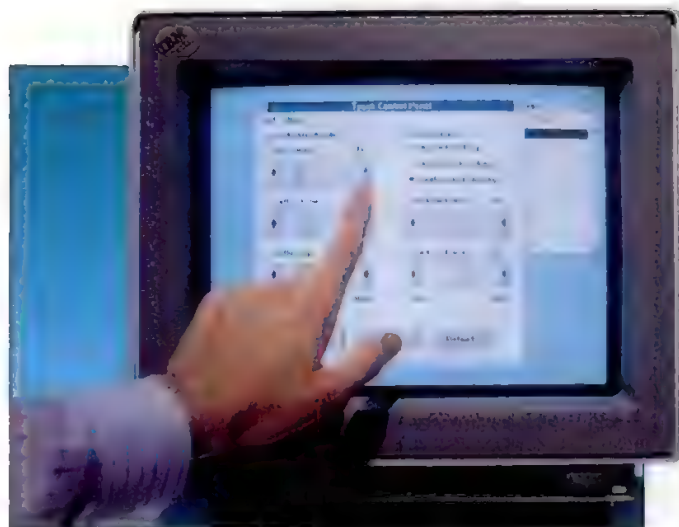
Requires: DOS 4.0 or later, or OS/2 1.20.1.

In Short: IBM's new 3.5-inch magneto-optical drive offers very much the same performance as the slower 5.25-inch MO drives currently on the market, but at one-half of the price. The 128MB rewritable disks are ISO and ANSI standard for interchangeability with other manufacturers' drives.

CIRCLE 708 ON READER SERVICE CARD



IBM's 3.5-inch Rewritable Optical Drive provides 128MB of removable storage on ISO and ANSI standard media and, in theory, should be compatible with SCSI-2.



Pressure transducers in the PS/2 Touch Display 8516 replace earlier image-distorting overlays.

IBM Relaunches the Touch Display, This Time for Multimedia

HANDS ON
by Matthew J. Ross

The last time IBM introduced a touch-screen display for PCs, it was a novelty. Now touch screens are more prevalent, especially on automated teller machines. This time, IBM is aiming touch screens at the multimedia market.

The PS/2 Touch Display 8516 does not use the overlays that slowed down and distorted the color earlier. It doesn't even need a special adapter; a standard VGA or XGA adapter and a PS/2 mouse port suffices. And the touch mechanism works with any input device—your finger, a pen, pencil, etc.

Pressure transducers at each corner of its screen report the exact (x,y) touch location and the amount of applied pressure (the z coordinate). Developers can create touch-screen applications that use three dimensions, using the degree of pressure as a criteria in user input.

The touch area equals the resolution of the display: either VGA or XGA. The 8516 monitor also works as a touch screen with IBM's 8514/A, but only at VGA resolution.

The display connects to a PS/2 in two places: Video output comes through the VGA or XGA adapter and the user input

is transmitted to the PS/2 mouse port. A PS/2 mouse can be connected to the 8516's mouse port. Data is interleaved, so both remain active.

We tested the touch screen under OS/2, Version 1.3, on the new PS/2 Model 57 SX. It operated smoothly with both the mouse and touch-screen drivers loaded simultaneously, although the mouse was preferable for most operations. It was possible, but difficult to invoke a double-click with the touch screen while running OS/2.

Most users won't face this difficulty, though, since they will likely be working with touch-screen-specific software.

The Touch Display 8516 will be available through IBM dealers starting September 17, 1991. ■



FACT FILE

IBM PS/2 Touch Display 8516
IBM Corp., Old Orchard Rd., Armonk, NY 10605; 800-426-2468

List Price: \$1,695

In Short: The 8516 works with a standard VGA adapter and a PS/2 mouse port, and any input device. It should bring multimedia closer to home.

CIRCLE 713 ON READER SERVICE CARD

NEW

Borland ranked best Quattro Pro beats Lotus 1-2-3

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Number of ...	Quattro Pro	Lotus 1-2-3	
	3.0	v. 2.3	v. 3.1
"Excellent"	7	2	3
"Very Good"	8	4	5
"Good"	0	5	4
"Satisfactory"	2	5	3
"Poor"	0	1	1
Overall score	8.4	6.3	6.5

REPORT CARD			INFO WORLD
SPREADSHEET SOFTWARE			
Quattro Pro			
VERSION 3.0			
Criteria	(Weighting)	Score	
Performance			
Formulas/analysis	(100)	Very Good	
Compatibility	(50)	Very Good	
Speed	(75)	Very Good	
Database	(75)	Excellent	
Graphics	(75)	Excellent	
Output	(50)	Excellent	
Macros	(50)	Very Good	
Consolidation/linking	(50)	Excellent	
Capacity	(50)	Very Good	
Network	(50)	Satisfactory	
Documentation			
Ease of learning	(75)	Excellent	
Ease of use	(100)	Very Good	
Error handling	(50)	Very Good	
Support			
Support policies	(25)	Very Good	
Technical support	(25)	Satisfactory	
Value	(100)	Excellent	
Final score			8.4

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	MastersPort™ 286	MastersPort 386SX	MastersPort 386SL	SupersPort® 486SX	SupersPort 486
Processor—Speed	286 — 12.5MHz	486SX — 20/10MHz	486SL — 20/8/6MHz	486SX — 20/10MHz	486 — 25/12.5MHz
Cu-Processor	80486™ socket	80486™ socket	80486™ socket	Upgradable to 486 20MHz	Integrated
Memory (Std. Max.)	1MB/2MB	2MB/4MB	2MB/8MB (64k cache)	4MB/16MB	4MB/16MB
Hard Disk Drive	40MB	60MB	60MB	120MB	120MB
LCD Size	Backlit 8.95"	Backlit 8.95"	Backlit 8.95"	Edgelit 10"	Edgelit 10"
Video—Gray Scales	VGA 16	VGA 16	VGA 32	VGA 64	VGA 64
Power Management	• Suspend/Resume • Sleep mode • Low battery operation	• Suspend/Resume • Sleep mode • Low battery operation	Premier System Management™ • Standby/Resume • Rest/Resume • Panic Save • Unattended communications	Intelligent Power Management™	Intelligent Power Management™
Software	MS-DOS® included	MS-DOS included	MS-DOS pre-installed; Microsoft® Windows™ v. 3.0 included	MS-DOS and Microsoft Windows v. 3.0 pre-installed	MS-DOS and Microsoft Windows v. 3.0 pre-installed
Weight (with battery)	6.6 lbs.	6.6 lbs.	6.8 lbs.	15 lbs.	15 lbs.

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CIRCLE 732 ON READER SERVICE CARD

First Looks

Utilities

CONTINUED FROM PAGE 35

features and utilities. New to Version 7.0 is an impressive remote-control program that supports compression during file transfers, and can even translate between different graphics modes in the remote and local machines. Passwords and scripts add to the program's security and convenience.

Central Point has also added a Windows-based backup program that conforms to the menus and file structure of its familiar DOS backup program. Version 6.0 of the DOS backup program had unacceptably weak error-handling; Version 7.0 seems mostly bulletproof, although early copies sometimes locked up after writing 12 to 16 disks. No other Windows backup program approaches its speed and unique support for tape drives.

Also new are a simple Windows program launcher (many shareware products are far superior), application-specific file viewers in the file manager and file finder, and an automatic scheduler for the backup and remote-control programs.

Other new features in *PC Tools* that were obviously inspired by utilities introduced in earlier versions of *The Norton Utilities* are a nondestructive low-level disk formatter, TSRs that encrypt files on the fly or warehouse deleted files for guaranteed recovery, and a utility for repairing spreadsheet and

A HEAD-TO-HEAD COMPARISON OF THE TOP-SELLING UTILITY PROGRAMS		
	The Norton Utilities, Version 6.0	PC Tools, Version 7.0
Application launcher	■	■
Batch enhancer	■	■
File manager	■	■
Keyboard macros	■	■
File finder	■	■
Quick directory changer	■	■
Desktop utilities	■	■
Communications	■	■
Remote control and file transfer	■	■
Backup	■	■
Undelete	■	■
File encryption	■	■
Disk cache	■	■
Defragmenter	■	■
Sector editor	■	■
Partition editor	■	■
Interleave adjuster	■	■
Automatic disk repair	■	■
Virus detector	■	■

■—Yes □—No

database files.

PC Tools' Shell is a file manager and application launcher (which also runs as a TSR) that has improved menus and a cleaner, more customizable interface. Installation automatically adds major applications to the menu when it finds them on your disk. The desktop (also an optional TSR) adds a primitive communications module to the tool suite.

You can use the desktop for e-mail via MCI Mail or CompuServe, but its filing options don't approach those of *Lotus Express*. I could never get the MCI Mail script to function.

The full *PC Tools* package fills 9MB of disk space—almost enough to fill the hard disk on an original XT—even though much of it is compressed with the PKLITE utility.

You need to thumb through seven separately and inadequately indexed manuals to find the information you need on the utilities and their interactions. Fortunately, each program in the package can access more than 1MB of hypertext help covering all the programs.

Early copies were marred by bugs and design anomalies that prompted thousands of messages on Central Point's CompuServe forum. If you installed on drive D:, the communications program looked for essential files on drive C:. When you

logged on to a new drive, the file manager often locked up. If you use the program's optional graphics screen fonts, which add to its Windows-like appearance, the ASCII table shows *PC Tools' special screen characters* instead of real ASCII ones.

Some of these problems were fixed in copies that shipped in July; other corrections are available on Central Point's BBS. The remaining problems should be solved by the time you read this.

Most of *Norton's* Version 6.0 consists of fine-tuned revisions of Version 5.0. *Norton* can now work with the deletion-recovery tools included in DOS 5.0, and its utilities run safely under DOS's task switcher.

The major addition to *Norton* is NDOS, a compact replacement for COMMAND.COM, and an enhanced version of the shareware utility 4DOS (reviewed in First Looks, May 6, 1989).

NDOS includes convenience features like command recall and command aliases more elaborate than those in DOS 5.0's DOSKEY, automatic associations between file extensions and applications, command recall, and many other conveniences that ought to be in DOS but aren't. NDOS won't save you any RAM if you use it in place of DOS 5.0's COMMAND.COM, but it can save

20K to 30K when used with earlier DOS versions.

Norton continues to surpass *PC Tools* and everything else in the power and flexibility of its disk and sector editor. It gives you more control over the contents of your disk than anything else on the market, and now even lets you access a disk's diagnostic cylinder. You can split the screen and work in two sectors at the same time.

If you really know what you're doing, you can edit the partition table with the program doing the necessary calculations for you. A new memory-display option lets you copy conventional memory blocks to a file or sector. Every expert PC user needs this incomparable program, especially when nothing else can recover lost data.

You'll need about 2.5MB of disk space to install the full *Norton* package. The program files are installed in a proprietary compressed format that slightly slows loading. An installation option lets you expand one or more programs for improved speed.

Norton's new release seems largely bug-free, although *Windows* has problems when some of the *Norton* TSRs load into upper memory blocks via DOS 5.0, and a few NDOS commands don't work as documented. The help screens are unhelpfully arranged, and the help screen for the "Memory Dump" feature in the disk editor simply reads, "This dumps memory." A promised maintenance release will include fixes.

As in earlier versions, both

CONTINUES ON PAGE 46



FACT FILE

PC Tools, Version 7.0

Central Point Software, 15220 NW Greenbrier Pkwy., Beaverton, OR 97006; 800-445-4208, 503-690-8088.

List Price: \$179; upgrade \$49. Requires: 640K RAM, DOS 3.0 or later.

In Short: An amazing range of utilities, now including the best Windows backup program and a powerful remote-control utility.

CIRCLE 706 ON READER SERVICE CARD



FACT FILE

The Norton Utilities, Version 6.0

Symantec Corp., 10210 Torre Rd., Cupertino, CA 95014; 800-343-4714, 408-253-9600.

List Price: \$179; upgrade \$39. Requires: 512K RAM, DOS 2.0 or later.

In Short: A new COMMAND.COM replacement and unique disk editor make *Norton* the best single package for data recovery.

CIRCLE 705 ON READER SERVICE CARD



Our Latest PostScript Printer Technology Impressed The Experts...



MacUser,
Editor's Choice Award
(Eddy), Jan. 9, 1991



PC/Computing,
Most Valuable
Product,
Nov. 1990



BYTE,
Editor's Product
Merit Award,
Jan. 1991



Personal Publishing,
1990 Outstanding
Achievement Award



...So We Decided To Give Them More Of A Good Thing.

Before we developed the QMS-PS® 410 four page-per-minute laser printer, we performed one very important task. We listened to what you wanted. Then we engineered a printer light years ahead of the rest with features that aren't available on other printers at any price.

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and 825 can receive data simultaneously to LocalTalk®, RS-232C serial and Centronics® parallel interfaces, which makes them the best on the market for mixed computer environments. All this and more is the result of QMS's exclusive ASAP™ III technology (Third Generation Advanced System Architecture for PostScript). And it's this proprietary QMS® technology that wins awards *and* customers.

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For even greater flexibility, these printers feature standard HP® LaserJet® Series IIP emulation to support non-PostScript printing applications. And a variety of options makes the printers easily expandable. HP-GL®

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- SIO-Simultaneous Interface Operation (allows the printer to receive data from three interfaces simultaneously)
- LocalTalk, RS-232C serial and Centronics parallel interfaces (connects to IBM® PC's, Apple® Macintosh® computers and most mini computers and mainframes)
- 45 resident Adobe PostScript typefaces (all can be scaled from 4 points upward, rotatable, all with multilingual character sets)
- Front Panel Display on QMS-PS 815 & 825 (16-digit multilingual LCD array conveys printer status, allows user to quickly configure printer)
- Resident HP LaserJet Series IIP & PostScript emulations (prints PostScript & HP applications, HP-GL emulation cards available)
- QMS ASAP III Technology and 68020 Microprocessor (exclusive technology means fast first-page-out performance)
- PS Executive Series™ Utilities Software (to easily set printer parameters)

emulation cards, HP compatible font cards, memory upgrades and extended paper handling capabilities are all currently available.

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As a recognized leader in PostScript printer technology, QMS maintains a commitment to customer satisfaction by providing free, responsive technical support. And to keep your QMS printer operating at its peak, QMS National Service offers a variety of service options. Call us today and see how QMS quite simply makes the best PostScript laser printers in the world. Or FAX QMS Product Information at (205) 633-4866.

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*patent pending

First Looks

Aldus Persuasion's Outliner View Simplifies Creation of Powerful Shows

HANDS ON
by Lissa Simons

Business presenters usually fall into one of two categories: those who work best with words and those who see everything as an image.

Until now, the presentation graphics market has reflected this either-or attitude. Text-oriented people favor form-based programs like *Harvard Graphics* and *Lotus's Freelance*, and those users partial to pictures worked best with true WYSIWYG programs like *Microsoft PowerPoint*.

Aldus is accommodating both working styles with its \$495 presentation graphics program, *Persuasion*, long popular on the Mac and now available for *Windows*. (The formal name of this brand new product for the PC, *Aldus Persuasion 2.0 for Windows*, is confusing. Aldus designated it the second version to maintain consistency with the Mac version.)

You can enter or import your text into *Persuasion's* fully integrated outliner (as ASCII, *WordPerfect*, *Word for Windows*, *DCS*, or *.RTF* files) and automatically format it by assigning masters that contain text placeholders. But you are also enabled to use the two-way link between the placeholders and the outline to enter text in the WYSIWYG slide-view mode, and transparently create a complex outline.

In addition to the standard word processing features of the outliner (such as a spell-checker and search-and-replace functions), *Persuasion* allows you to control the appearance of slides by associating each outline entry with icons that designate the chart type—something that even the Mac version of *Persuasion* can't do.

You can indicate whether a slide should be formatted as a ti-

tle, text, organization, or numerically driven data chart. Other powerful symbols let you transform multilevel text into nested slides, or enter breaks that will force the copy into separate text blocks.

Persuasion's power doesn't end with the outliner. You can format a presentation by assigning a master in any of the program's three working modes—outline, slide, and slide-sorter views. And the master contains formatting information for numerically driven graphs, as well as for text charts, color choices, and positioning information.

Persuasion often gives you access to functions in more than one working view. The outline and slide sorter, for example, share the ability to reorder slides by dragging them to a new location. And you can open *Persuasion's* built-in data manager in either the outliner or slide view.

The data manager (and the associated Chart Info dialog box) are the tools for creating standard business charts (bar, column, line, area, pie, scatter, high-low, and tables). Though

Persuasion imports information from *dBASE*, *Lotus 1-2-3*, and *Microsoft Excel* files, it can't maintain live links with any external program. A limited form of DDE can display *Excel* charts, but you must still update information manually by reimporting the latest data.

With 256 rows by 256 columns—over 65,000 data points per chart—graphs can be information-intensive. You can make very complex charts by combining chart types, such as displaying a line plot on top of a bar chart.

Don't expect lots of sophisticated formatting features in the charting dialog box. In fact, the only chart elements that you can fine-tune here are the x,y axes, which can appear as either logarithmic or linear. Other controls—such as a 3-D effect, data values, legends, graph frames, and titles—can be turned on or off, but not customized.

Instead, you fine-tune a graph's appearance by directly manipulating chart elements in the WYSIWYG slide view, where you can edit text, assign new type specs, recolor objects, explode pie slices, and reposition the legend.

Best of all, you can carry out all these functions without losing the link to the data sheet. Even more extensive changes are possible if you ungroup the chart. And *Persuasion* courteously provides a special com-

mand, *Regroup*, that will reestablish the link to the graph's associated data sheet after you've made your alterations.

You must be in *Persuasion's* WYSIWYG slide view in order to access the *PageMaker*-like toolbox. Here you can invoke the text tool to either modify placeholder text, or to add free-floating annotations that will not be automatically included in the outline. Several additions to the toolbox allow you to draw freehand curves and editable polygons, as well as to invoke the charting function.

Likewise, only the slide view allows you to import art elements (in CGM, EPS, WMF, or TIF format), or invoke menu functions to align, group, rotate, or flip objects. You can even perform some of these drawing operations on data charts. For example, overlaying two charts—one of which has been flipped—is a neat work-around that allows you to visualize data against a dual y-axis.

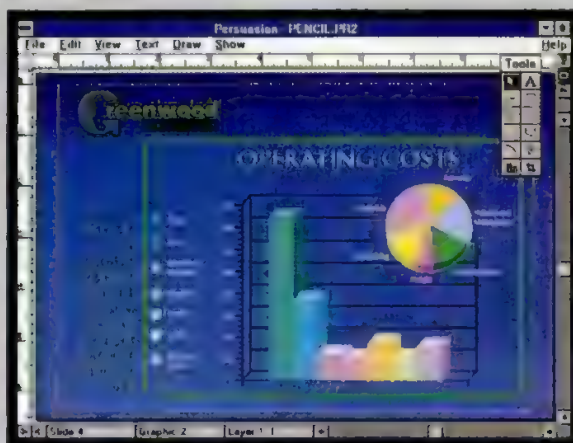
Though *Persuasion* can display 24-bit scanned images, the program's internal color palette contains only 200 colors. Of those, only 40 hues (20 custom and 20 scheme colors) can be edited using either an RGB or HLS model. Be warned, the 40 editable colors are mapped to objects in your presentation. If you import a new color scheme, all of the objects will take on the new colors automatically.

The most important activity that takes place in the slide view is the modification and creation of auto templates—the key to *Persuasion's* power. Simply stated: An auto template is a collection of chart-specific masters. Though masters can share a common, unifying background with logos, rules, or a gradient wash, their true power lies in their differences.

For example, a text-intensive chart might contain placeholders for the headline, subtitle, and individual columns, while a data chart would have a placeholder for a title, a bar graph, and an accompanying caption.

When the time comes to image your presentation, *Persuasion* is ready; it comes with two

CONTINUES ON PAGE 46



Persuasion's ability to subselect and edit individual elements in a chart—which remain linked to the underlying data sheet—allowed us to change the text in the legend and drag it to a new location.



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- Duplexing feature prints on both sides in one pass
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*Contact QMS for availability of network options.

*Patent pending

First Looks

Utilities

CONTINUED FROM PAGE 42

Norton and *PC Tools* offer standard disk utilities: deleted file recovery, defragmenter, disk cache, file finder, disk tester, disk repair utility, and a nondestructive low-level formatter for resetting interleave.

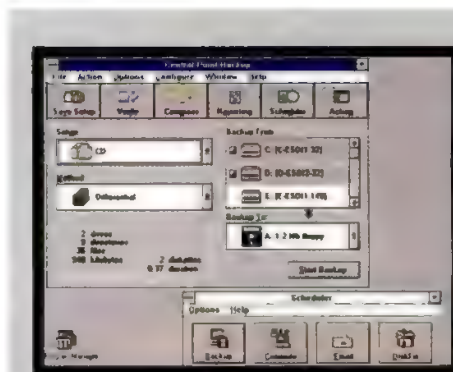
In these utilities *Norton* tends to outperform *PC Tools* in speed (although the superb *PC Tools* cache is both smaller and faster) but *PC Tools* sometimes outdoes *Norton* in its range of options.

If you use all the fail-safe utilities for tracking or warehousing deleted files in both *PC Tools* and *Norton*, you'll proba-

bly never lose a file. But if you don't want to use a TSR and a lot of disk space to intercept deletions and warehouse the data, you'll find that *Norton's* Undelete can recover some files that you'll lose with *PC Tools*.

Norton's Image program, which saves FAT and directory data to use when undeleting, but doesn't warehouse the data in a hidden area of the disk, is much faster than *PC Tools' Mirror*. DOS 5.0 has the *PC Tools' Mirror* built in, and *Norton* can use *Mirror's* data if you use it instead of Image. (You gain nothing and lose speed by preferring *Mirror* to Image.)

The rival file finders are typical of the two packages. *Norton* searches a disk for a filename on your disk about 25 percent faster. However, if you



PC-Tools, Version 7.0 has added several new utilities, including a remote-control function with on-the-fly compression for file transfers, and 30 viewers to the file searcher.

want to search for files that contain a specified string, *PC Tools* is typically 10 percent faster—but only because *PC Tools* stops reading a file when it finds the first match, while *Norton* continues to read the whole file and tells you how often the string occurs.

When you want to view files located by the file finder, *Norton* displays them quickly as raw, unformatted data. *PC Tools* is slower, but automatically loads a viewer that gives a formatted display of about 30 file types. For text files, *Norton's* speed is sufficient. For spreadsheets and databases, the *PC Tools' viewers* are essential, and can save you the trouble of loading *1-2-3* or *dBASE*.

While the two packages' system-information programs

cover most of the same territory, they have different strengths. *Norton* gives you details about device drivers and extended memory that you won't find in *PC Tools*. But *PC Tools*, and not *Norton*, tells you which TSRs are loaded in upper memory blocks.

PC Tools gives you an unprecedented range of utilities in a single package. It has menu-driven conveniences for beginners and advanced command line power for experts. *Norton* offers expert users an incomparable disk editor plus a *COMMAND.COM* replacement that can dramatically increase your control over your computer.

The bad news is that you probably want both. The good news is that both are worth the price. ■



Version 6 of *The Norton Utilities* includes a *COMMAND.COM* replacement and a more powerful disk and sector editor.

Aldus

CONTINUED FROM PAGE 44

utilities that can communicate with the *MAGiCorp* and *Autographix* slide service bureaus (a *Genigraphics Corp.* driver is available as a special order). And the inclusion of *Adobe Type Manager* gives users jagged-free fonts for *LaserJet* or on-screen presentations.

Though *Persuasion's* layering capability is intended to manage complex drawings, it also is a wonderful tool to easily generate progressive builds for text and data charts.

Persuasion goes programs like *IBM's Hollywood* one better by automatically generating builds for printer and slide output as well as for screen shows. Though *Persuasion* lacks a runtime version, its screen shows benefit from 14 different transi-

tion effects that can be applied to individual layers of a slide, to individual slides, or to all the slides globally.

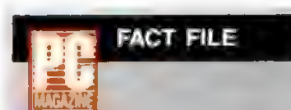
And while virtually all of the *Windows-based* presentation programs on the market create speaker notes and audience handouts, *Persuasion* and *PowerPoint* are the only ones to provide an associated master, so that you need position and resize the thumbnail only once.

Of course, *Persuasion* isn't perfect. Because auto templates are customized for particular output devices, copying a set of masters from one presentation to another requires that you reconcile incompatible page sizes in the Page Setup dialog box. And cutting and pasting slides between presentations won't be truly easy until *Persuasion* supports MDI (Multiple Document

Interface). In addition, the small clip-art collection contains more simple symbols than illustrative pictures.

Persuasion's outline is simply a better text-entry paradigm than the form-driven approach of DOS-based programs like *Harvard Graphics* or *Freelance*. And its ability to directly manipulate chart elements lives up to the promise of object-orientation that has been only partially implemented by other *Windows-based* programs like *PowerPoint* or *Hollywood*.

With 55 auto templates, the automatic generation of speaker notes and audience handouts, and mini-palettes that put the most-used colors, lines styles, or fill patterns at a presenter's fingertips, most business users can be productive almost immediately. ■



Aldus Persuasion 2.0 for Windows

Aldus Corp., 411 First Ave. South, Seattle, WA 98104-2871; 206-622-5500.

List Price: \$495.

Requires: 286-based PC or better, *Windows 3.0*, 2MB RAM.

In Short: *Persuasion's* integrated outline still distinguishes it from the competition. The program contains powerful formatting options, and strong interactive, WYSIWYG editing tools for data-driven graphs. If you are willing to work through modifications to the auto templates, this is a presentation program you won't outgrow.

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Better Windows

Solve memory problems

QEMM 386 makes the most of every last 'K'. DESQview uses that memory to run multiple programs.

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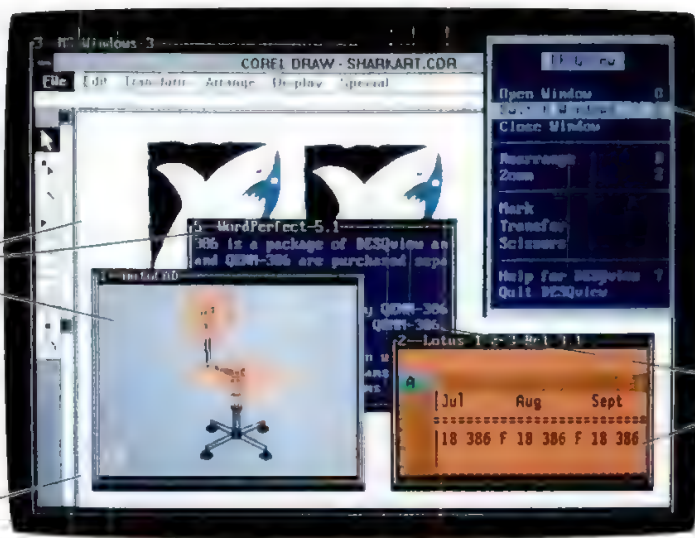
Run multiple programs side-by-side in windows. 'Background' programs can continue to run.

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DESQview even lets you run Microsoft Windows



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Access programs or DOS in a window with just a few keystrokes or mouse clicks. It's that simple.

See multiple files

If your programs allow it, DESQview lets you run the same program in two or more windows. Great for comparing files

Cut and paste data

Transfer data between programs with a few keystrokes.

Handle large programs

Run standard DOS programs side-by-side with DOS-extended programs like 1-2-3 Release 3.

DESQview. The Multitasking, Windowing Environment.

Once the power user's secret, DESQview has been discovered by computer knowledgeable people everywhere. Over 1,000,000 people have bought DESQview.

Multitasking; windowing, using keyboard or mouse commands, it's all easy with DESQview.

DESQview 386 2.3 lets you use your favorite DOS and DOS-extended programs in windows side-by-side on 386SX, 80386 and i486 PCs. As you can see above, you can even run Microsoft Windows

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within DESQview.

DESQview 2.3 gives 8088, 8086 and 286 PCs with additional memory most of the same capabilities with surprisingly little performance trade-off.

Whatever programs you use—DOS, extended DOS or Windows—and whatever hardware you have, whether 8088 or i486 or something in between, DESQview is still the best way to get the most out of the hardware and software you own today.

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Quarterdeck

Quarterdeck Office Systems, 150 Pico Boulevard, Santa Monica, CA 90405 (213) 392-9851 Fax (213) 399-3802

CIRCLE 338 ON READER SERVICE CARD

First Looks

Q&A 4.0 Adds a Forms View, External Lookups, And Crosstabs While Keeping the Same Speed

HANDS ON
by Joe Salem

When we last reviewed *Q&A*, Version 3.0 ("Flat-File Databases: Fast Answers to Easy Questions," June 26, 1990), it just missed receiving the Editors' Choice award. The over 100 new features Symantec Corp. has added for Version 4.0 may be enough to push *Q&A* back to the top position among flat-file databases. (Another comparison is planned for later this year.)

While *Q&A* remains forms-oriented, Version 4.0 adds a number of enhancements that aid data handling. The most welcome addition is a table view. A field can now hold up to 32K of data. The Field Editor can be used to edit data that is too wide to fit in the table.

The user can also define templates or formats (such as "all uppercase") for data fields, making the format for data entry and lookup consistent. Restrictions such as "read-only" or "required" can be placed on a field. Specifications for retrieval and sorting can be saved for repeated use, saving typing time and reducing errors.

Symantec has also added semirelational functions, chief among these is the new Posting feature. This feature lets the user add or replace data from the current database to an external *Q&A* database file. A transaction log is created that details the data posted in the external file and indicates whether the post was successful.

Data lookups can also be performed from external *Q&A* databases, or directly from *dBASE III/IV* data files, without having to import the data. Drivers that let *Q&A* 4.0 query and report on data from SQL database servers are also available

directly from Symantec (a mail-in card is included in the package). Oracle and Gupta SQL servers are currently supported, and Symantec plans to support other database servers in the future. It's important to note that EMS memory is required to use the SQL drivers.

Memory management has also been improved for 4.0; *Q&A* will automatically use EMS or XMS memory (provided by HIMEM.SYS or a third-party 386 memory manager). This allows for more-complex data queries and larger reports. A Microsoft or 100 percent compatible mouse can also be used to navigate through the menus or forms.

Programming functions have been enhanced as well. Custom menus can be designed, and the database can be locked in order to prevent users from modifying the design. Data can also be protected to the field level, including read-only, read/write, and hidden access; up to eight different user groups can be created to control the above restrictions.

One of *Q&A*'s most unique features has always been its Intelligent Assistant (IA), a natural-language interface that lets you enter queries in plain English. Of course, in practice the IA was never as intelligent as you might wish, stumbling on seemingly obvious queries.

In 4.0, the IA has been enhanced with the addition of a Query Guide that lets the user choose the data operators, the field names, and unique values for the fields from pop-up menus, simplifying the process of creating an IA statement.

To use the pop-up menus, the IA has to scan your database to create an index of unique values. This is time-consuming if the database is large, but it only has to be done once each time you create a query in English.

Full font support has been added to the Write function of *Q&A*, including proportional and scalable fonts; up to 9 different fonts can be included in a document or report. Over 60 font files and support for over 100 printers are included. Document and character attributes are shown on-screen, and on systems with graphics capabilities the user can see a page preview of the final document, giving complete control over the final appearance of the document. A built-in thesaurus has been added as well.

Symantec has added crosstab reports to *Q&A* 4.0, letting the user summarize the data by totals, averages, variance,

count, and/or percentages, minimums/maximums, and standard deviation. The Report functions have also been moved with the addition of has been lost and a preview function for *dBASE III/IV* data files.

Data can be imported from *Lotus 1-2-3* and *Symphony* spreadsheets, or can be imported from and exported to *dBASE*, *Paradox*, *Professional File*, *IBM Filing Assistant*, *DIF*, and *ASCII* formats. Documents in *WordPerfect*, *Microsoft Word*, *MultiMate*, *Professional Write*, *DCA*, and *ASCII* formats can be imported or exported. *Q&A* 4.0 also continues the excellent network support established by its predecessors, including full record locking and user updating of changes made to the database.

The additional power and features have not adversely affected *Q&A*'s performance—nor has it been improved much over previous versions. Informal tests show 4.0 to be about equal in performance to 3.0.

The improvements in the Intelligent Assistant, table views, reports and word processing functions will help *Q&A* 4.0 retain its leadership position among flat-file databases. For casual users who don't need the full features of a relational database, *Q&A* is a powerful alternative. The inclusion of a full-featured word processor makes it ideal for laptop and notebook users.



Category	Subcategory	Total	Average	Variance	Count	Percentage
Apple	Apple II	100	50	25	10	10%
Apple	Apple III	200	100	50	20	20%
Apple	Apple III Plus	300	150	75	30	30%
Apple	Apple III XE	400	200	100	40	40%
Apple	Apple III GX	500	250	125	50	50%
Apple	Apple III SE	600	300	150	60	60%
Apple	Apple III Plus II	700	350	175	70	70%
Apple	Apple III Plus II XE	800	400	200	80	80%
Apple	Apple III Plus II GX	900	450	225	90	90%
Apple	Apple III Plus II SE	1000	500	250	100	100%

Crosstab reports are one of the more than 100 new features that Symantec Corp. has added to *Q&A* 4.0.



FACT FILE

Q&A, Version 4.0

Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; 408-253-9600.

List Price: \$399; network pack (additional three users), \$499; upgrade from Version 3.0, \$85.

Requires: 512K RAM (640K recommended), hard disk, DOS 2.0 or later, EMS for the SQL drivers. DOS 3.1 or later for network use.

In Short: A powerful flat-file database program with features that make it ideal for casual or laptop/notebook users.

CIRCLE 707 ON READER SERVICE CARD

Important news for you.

ZEOS has just released a new line of incredibly HIGH PERFORMANCE, LOW COST computer systems. Based on upgradable CPUs, these new systems are absolutely incredible. Suggest you review this right away.

**APPROVED
FOR RELEASE**

ZEOS Engineering Department
Specification Detail

Upgradable. High Performance. Low Cost. Unbelievable? Believe it! Because now ZEOS® gives it all to you in one complete package.

Starting complete with the ZEOS 386-25s at only \$1395 right thru '486-33 MHz systems starting at \$1795, computing will never be the same again! And it's not just the prices that make these new systems hot. It's Performance and Upgradability as well.

UPGRADABLE CPU

When we first sat down to design these new systems, we wanted computers that would *blow the doors off* anything else out there. Plus, we wanted you to be able to upgrade from one CPU to another as your computing requirements changed, *without having to buy an entirely new system*. The results?

Incredibly low cost, high performance systems so very advanced you can move freely from the '386 family of processors to the latest '486s all without a moment's hesitation.

Now, you can pick your power! Today *and* tomorrow. Choose from high speed '386-25 and 33MHz systems, either cached or non-cached, plus the '486SX and '486-33MHz with or without a secondary cache. Whichever you decide upon you



Upgradable.

Hot New ZEOS'386

know that as your computing requirements change, your processing power can change as well. But are the prices really that good?

Yes. *Absolutely Yes!* The prices really *are* that good, and the quality too. Because when you buy from ZEOS you're buying directly from the manufacturer.

Starting with the main system board, your new computer is designed and built by us right here in Minnesota. That saves money for you. And your ZEOS factory direct advantages are evident not only in the price, but in the performance and quality of your system too.



Z-SPEED METER

To help you select the processor option that's right for you, we have developed the Z-Meter. The Z-Meter shows you the relative performance gains achieved by moving from one processor module to another—fast, faster, fastest! No matter which system you select you can be sure of one thing—these babies are Hot!

So if you're looking for a high speed, upgradable, rock solid system supported like

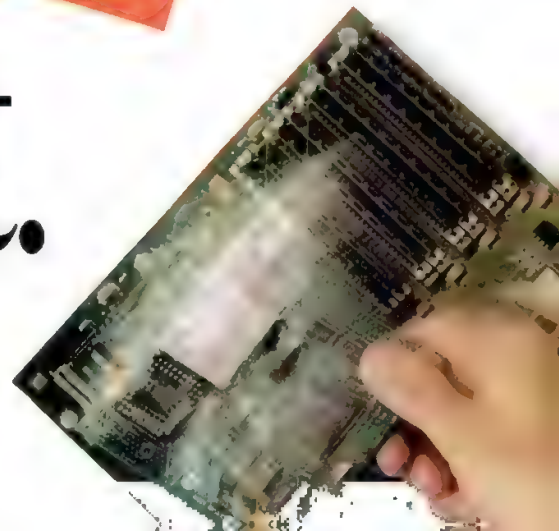
none other

and you

want incredibly low prices,

you've found your company.

And your computer. Read on!



Low Cost.

and '486 systems!

ZEOS COMPLETE SYSTEM PACKAGE #1

- The Processor and Speed of your choice plus future upgradability!
- 1MB of High Speed 53ns DRAM, expandable to a system total of 32MB right on the motherboard.
- 42MB High Speed IDE hard drive with its own cache.
- 1.2 MB or 1.44 MB Teac® floppy drive.
- ZEOS 14" flat screen Hi-Res amber monitor with Tilt/Swivel base.
- Shadow RAM and EMS support for enhanced performance.
- ZEOS/RS 101 key SpaceSaver keyboard.
- Two Serial, one Parallel & one Game Port built right onto the motherboard.
- 7-16, 1-8 bit expansion slots. 80387 math co-processor support for '386 systems.
- Rugged ZEOS SpaceSaver case with twin cooling fans for added reliability and product life.
- Seven drive bays and our custom 300 Watt power supply for your future expansion!
- Includes ZEOS 24 Hour a Day Toll Free Technical Support and Customer Satisfaction package.

PACKAGE #1

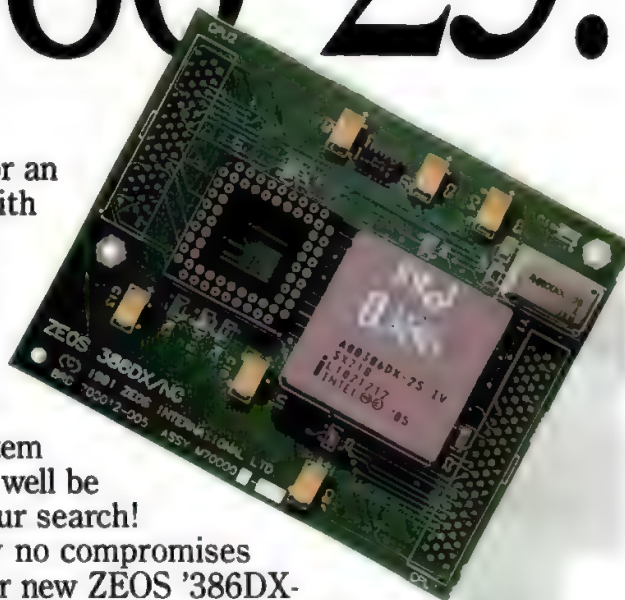
INCREDIBLE ZEOS PACKAGE #2

We take Package #1 and upgrade your ZEOS Modular System to include:

- 2 full Megabytes of Rip-roaring 53ns DRAM.
- Our incredible 85MB IDE hard drive with its own built in cache.
- Both the Teac® 1.2MB and 1.44 MB floppy drives.
- The awesome Diamond SpeedStar Plus VGA graphics card Complete with 1MB DRAM.
- ZEOS 14" High Res VGA Mono Monitor with Tilt & Swivel base.
- Microsoft® DOS plus Microsoft Windows plus a Microsoft Mouse.

PACKAGE #2

386-25!



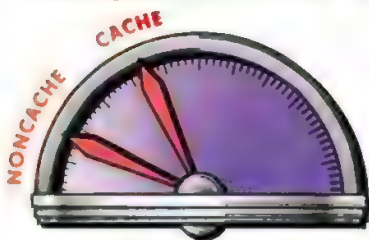
If you're looking for an economical system with a lot of power, you'll definitely want to start by taking a good look at the amazing ZEOS 386-25.

At only \$1,395 for our Complete System Package #1, this may well be the place you end your search! There are absolutely no compromises with this system. Your new ZEOS '386DX-25 is a full powered ZEOS system packing all the punch you'll need for virtually any desktop applications. Not only that, but your new ZEOS 386-25 also comes with all of your ZEOS *designed in* extras.

These extras start right with your own upgradable processor. You have the power you need now *and* the ability to add more later!

Being able to upgrade processors helps protect your investment now and for a long time to come. That's ZEOS. And that's just for starters!

Perhaps the first thing you'll notice is your incredibly fast IDE hard drive. Designed for speed, yours will show everybody what speed is all about. As for floppy drives, we use only genuine Teac®. They're the very best. It's quality you'll come to appreciate. You'll also like the fact that they both plug right into the motherboard, saving you an extra expansion slot. And when it comes to expansion, ZEOS is the winner once again!



Z-SPEED METER: ZEOS 386-25

The ZEOS 386-25 is perhaps the perfect desktop system. For even more power, add a blazing 128K Cache for only \$200!

Because you are also going to be receiving our *seven bay* SpaceSaver desktop case. Loaded

with seven drive bays, this case occupies less room than most five bay cases! Plus,

\$1,395

to make sure you have plenty of power, now *and* in the future, we're including the very best *300 watt* power supply that money can buy. If you want the *power* to expand, you want ZEOS power—300 watts and nothing less! And there's more too.

ONLY \$2495

Like plenty of room for you to add expansion cards any time you wish. Because every ZEOS system comes with *eight expansion slots*. One is occupied by your high speed video card and *seven are open for your use*. Your investment is protected in other ways as well.

Take our two *whisper quiet* cooling fans for instance. At ZEOS, we recognize the importance of cooling. So we have built into your system not one but *two cooling fans*. After all, the cooler your computer runs, the longer the components inside will last. It's an extra and it's yours because ZEOS always builds in reliability.



ONLY \$2995

Speaking of reliability *and* safety. Your *entire* computer system is Underwriters Laboratories listed (not just the power supply). Many computer vendors don't offer this important safety listing. We think you'll agree, *not* being UL listed definitely tells you something about the company and the product. Insist on a UL® approved system.

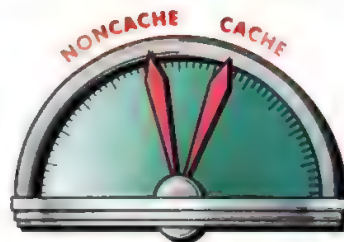
There are many advantages of selecting your new ZEOS 386-25. We've touched on a few of these advantages here while many more are discussed later in the section entitled "*Why ZEOS is your #1 Choice!*" Things like *24 Hour a Day Toll Free Technical Support*, our 30 day Money Back guarantee, warranties and much more. You can be sure of one thing...

Your new ZEOS 386-25 is one incredible system. With performance, quality, price, and support second to none, it might well be the last computer you'll need to buy for quite some time. Select between these packages *plus* our many available options! Why not give us a call right now! Call *Toll free 800-423-5891*.

386-33!

You read it right! The complete amazing blazing ZEOS 386-33MHz modular system starts now at only \$1,495. If you've been thinking you want more power, *this is it*. Power, price, performance *plus* your many other ZEOS advantages!

Like our new modular motherboard design. Now you can upgrade to an even higher performance microprocessor at any time. Businesses find this option very attractive. It nearly eliminates obsolescence and lets them balance their processing power with the changing needs of the users. Whatever *your* needs, you're sure to appreciate your other ZEOS design advantages as well.



Z•SPEED METER: ZEOS 386-33

Truly high performance ZEOS systems are now in the reach of everyone. The ZEOS 386-33 is a definite winner! Add even more speed with our 128K SRAM cache for only \$200! Incredible!

ONLY \$1495

room to do some other very special things. Like integrating



the IDE hard disk and floppy drive interfaces right on the motherboard. We've put our high speed I/O ports on the motherboard too. But what about the slots?

While others are trying to get you to accept fewer slots, we still give you *eight*. And of those eight expansion slots, seven are open for your future use while one is used for video (video standards change too rapidly to lock you into video on the motherboard). With all these open slots, you definitely have room for expansion. Plus, you have the *power* to expand.

ONLY \$2095

Because at ZEOS we have considered the *entire* issue of expansion. That's why we're giving you our 300 watt power supply *plus* two whisper quiet cooling fans. Moving more cool air through your system translates into longer component life. A larger power supply gives

\$1,495

you more power stability now *plus* the capacity for future expansion. It's a case of quality. And speaking of cases...

Your exclusive ZEOS SpaceSaver case is unquestionably the very best! Providing you with *seven* drive bays it's *actually smaller than most five bay cases!* And this baby is built. We've even gone so far as to specify the steel to be 0.20mm thicker than the cases used by most of our competitors. Speaking of competitors, here's another important feature many of them don't offer: The UL® safety listing!

Important to you, and anyone else using your system, is the fact that every ZEOS system is *Underwriters Laboratories Listed*. Not just the power supply. The entire system!

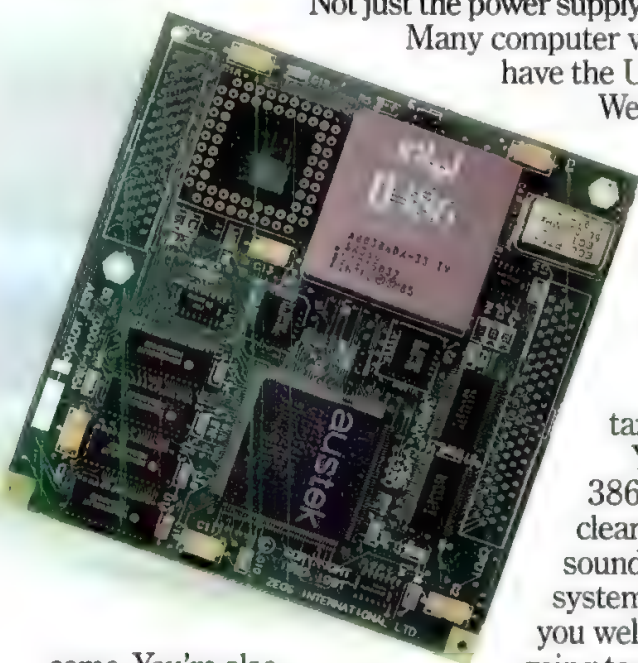
Many computer vendors don't even have the UL® safety listing.

We wonder why?

ZEOS systems carry the UL® seal because quality and safety are important to us. *You* are impor-

ONLY \$2595

ONLY \$3095



come. You're also many other ZEOS advan-

Hour a Day Toll Free Technical Support, our 30 day Money Back guarantee, our warranties and much more (be sure to read the section entitled "*Why ZEOS is Your #1 Choice*").

Consider performance and price, consider quality and service and support. Then choose from the systems here or let us add anything you wish from our huge list of available options. Whatever you select, it all comes down to this: The incredible ZEOS 386-33 is the *very best buy* for you. So why not give us a call right now! Your expert ZEOS Systems Consultant is waiting to give you a hand. *Call now Toll Free, 800-423-5891.*

tant to us!

Your new ZEOS 386-33MHz system clearly represents a very sound investment. It's a system that will serve you well for a long time to going to appreciate your

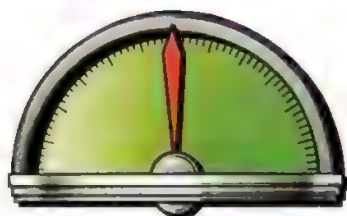
tages. Advantages like 24

486SX-2

This *definitely* is the real thing! Your own '486SX-20 starting from only \$1,595. If you want to move into the '486 world, this hot new ZEOS system may well be your entry point.

Equipped with it's built in 8K SRAM cache, just like it's

bigger '486-33MHz brother, your new '486SX processor delivers dazzling performance at near '386 prices. Add our optional secondary 128K Turbo-Cache and hang on—you're going for the ride of your life!



Z•SPEED METER: ZEOS 486SX-20

If you're interested in owning '486 processing power this is a great place to start! Turbo Charge your 486SX even more with our 128K TurboCache upgrade for only \$200 more!

Racing with you is one of the most advanced system boards in the computer industry. Using the very latest in high integration surface mount technology

and advanced manufacturing techniques, these new systems are *very reliable* and *very expandable*!

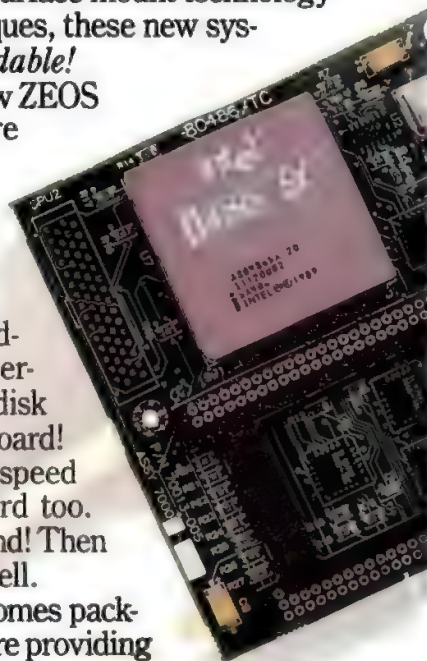
ONLY \$1595

Plus with your new ZEOS 486SX-20 you are

able to change processors as your own computing requirements change. In fact, as you will see, ZEOS prepares you for the future like nobody else.

For instance, in addition to upgradable processors, we've placed the interfaces for your high speed IDE hard disk and floppy disks right on the motherboard! We've also placed the celebrated high speed ZEOS I/O board on the motherboard too. Now you have even more room to expand! Then we give you the *power* to expand as well.

Because your new ZEOS 486SX comes packing a full 300 watts of power. We also are providing you with *eight expansion slots*; seven are open, one slot is for your high speed video card (with video standards



ONLY \$2195

0! \$1,595

changing quickly, we have elected not to put video on the motherboard). Now you have the power *and* you have the space to expand. So let's talk about quality.

Quality means dependable rock solid systems that last a long time. That's why every ZEOS case includes *two whisper quiet cooling fans*. We know that the cooler your system runs, the longer it will last. While we've provided you with plenty of slots and cooling we've also given you extra drive bays as well. In fact your new ZEOS case has *seven drive bays*, yet it's smaller than many 5 bay cases! Not only that, but every ZEOS system is UL® listed.

That's right! Your *entire* ZEOS system is Underwriters Laboratories listed (not just the power supply). Most of our competitor's systems are not UL® listed. A UL® listing says a lot about the

safety of a product; we believe it says something about the quality as well.

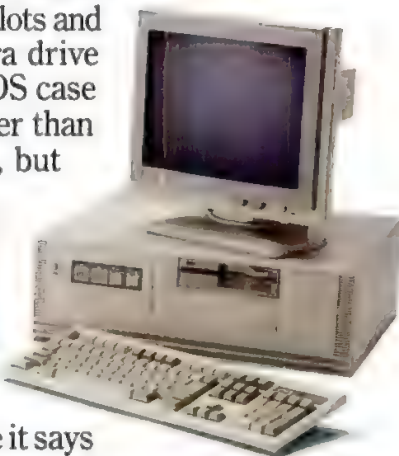
There are many reasons to buy your new ZEOS 486SX-20, not the least of which are Price, Performance and Quality.

Simple things make the difference too. Like *24 Hour a Day Toll Free Technical Support* and our 30 day Money Back guarantee (for even more ZEOS advantages be sure to see the section entitled "*Why ZEOS is Your #1 Choice!*").

Certainly, your decision to purchase the new ZEOS 486SX-20 is an easy one. You can select from any of the money saving packages shown here or add to them from our huge selection of options.

So why not give us a call right now! A friendly and knowledgeable ZEOS Systems Consultant is here to answer all your questions. *Call us now at 800-423-5891.*

ONLY \$2695



ONLY \$3195



486-33!



Now, you can possess the *incredible* processing power of your own ZEOS 486-33 MHz system for as low as \$1795. There is nothing else like it. And with price and features like this, there probably won't be for quite some time!

There is no question about it. Your new ZEOS 486-33 delivers performance the others only dream about. Opt for the addition of a secondary 128K TurboCache and you'll hit *Hyperspace* and never look back! And if Hyperspace isn't enough, look a little further. You'll

For Vertical Systems add only \$150.

find ZEOS has harnessed technology like nobody else and you're the beneficiary.

Because inside your new ZEOS system rests the very latest advancements in surface mount, high integration technology.

ONLY \$1795

As an example, we have freed two normally occupied expansion slots. We accomplished this by placing our high speed IDE hard and floppy drive interfaces right on the main board. We put the high speed serial, parallel and games ports there too. The result?

Eight expansion slots, *seven* of which are available for your future use! After all, expansion and non-obsolescence are what these great ZEOS systems are all about. That's why we've built in some other very important expansion features for you as well.

Like our *300 watt* power supply. Providing you with all the pure clean power you'll need right now, your ZEOS 300 watt supply also provides you with plenty of power for later as well. Plenty of slots, plenty of power. How about space? This is where ZEOS has performed something akin to magic.

It's your new ZEOS SpaceSaver case! Complete with *seven drive bays*, this incredible case is actually *smaller* than many cases offering only five bays. And we didn't stop there. We've also added a *second whisper quiet cooling fan*. Why? Because whether you add more to your system or

ONLY \$2395

not, the cooler it runs, the longer it will last. Now that's ZEOS *value*. Speaking of which. How about UL® listings?

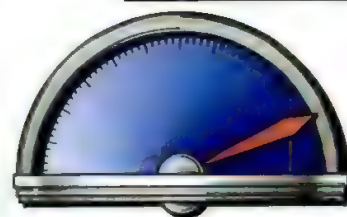


\$1,795

Right now every ZEOS system is UL® listed. This listing means your entire system (not just the power supply) has met the stringent safety requirements of Underwriters Laboratories. We believe UL® listings also say a lot about quality. And UL® safety listings are something many of our competitors simply don't (or can't) provide. At ZEOS quality and safety are important to us. *You* are important to us.

Price. Performance. Quality and Support. There are *many* reasons to buy your new ZEOS '486-33 system. Plus, your ZEOS advantages include *24 Hour a Day Toll Free Technical Support*, our 30 Day Money Back Guarantee and ironclad warranties, just to name a few (for more ZEOS advantages see the section entitled "*Why ZEOS is Your #1 Choice!*"). You simply can't go wrong!

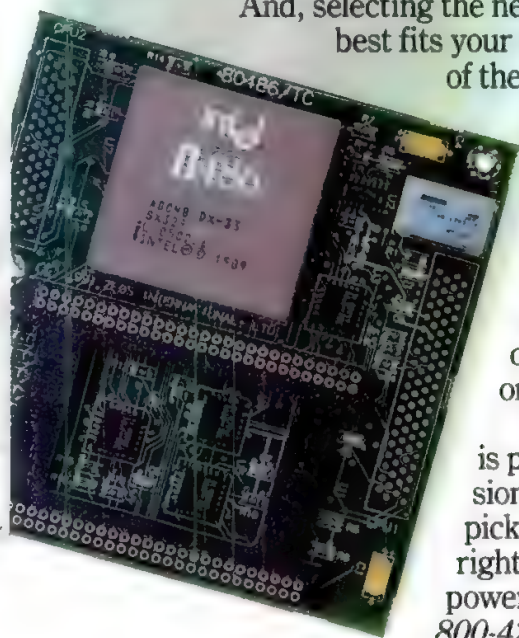
And, selecting the new ZEOS 486-33 system that best fits your needs is easy. Choose from any of the money



Z•SPEED METER: ZEOS 486-33

Top of the charts!

Chances are you've never seen speed like this before. Throw in the afterburners with our 128K secondary TurboCache at only \$200 additional.



saving

packages shown here. Or let your friendly and knowledgeable ZEOS Systems Consultant help you *configure exactly what you want* from our huge selection of upgrades and options. Whatever you select, one thing is for certain.

Buying your new ZEOS 486-33 is perhaps the best purchase decision you'll ever make! So why not pick up the phone and give us a call right now. Incredible ZEOS 486-33 power awaits you! *Call now Toll Free, 800-423-5891.*

ONLY \$3395

Pick Your Package

Or Let Us Custom Build to

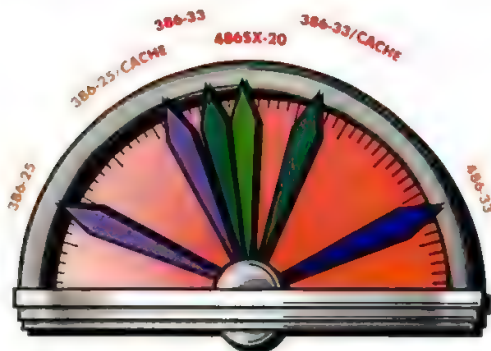
Now, ZEOS lets you pick the power you want for the price you want to pay! And with your new ZEOS modular system, the computer that's right for you today is also the computer that's right for you tomorrow.

You can start by picking the power you need right now. To help you out, we've designed the Z-Speed Meter. You can use the "Z-Meter" to compare the relative performance of each of the processor modules available to you today.

In the future, you can upgrade to even more performance with a new '386 or '486 processor module. And that's only the start of your many ZEOS system advantages. But what more could there be than dazzling performance, incredible prices

and upgradability? From ZEOS there's lots more.

Because your new ZEOS system is not only fast, it's absolutely *loaded with features*. Like our 300 watt power supply, eight expansion slots, twin cooling fans (for even more reliability) and our unique seven bay SpaceSaver case. And, *every ZEOS system is UL® listed.*



Z-SPEED METER

Let the "Z-Meter" help you pick the processing power that's right for you. The comparisons are easy to make. Fast, Faster or Fastest!

r Power, & Price!

Your Exact Specifications.

TAKE YOUR PICK!

	Pkg. #1	Pkg. #2	Pkg. #3	Pkg. #4
386-25	\$1395	\$1995	\$2495	\$2995
386-33	\$1495	\$2095	\$2595	\$3095
486SX-20	\$1595	\$2195	\$2695	\$3195
486-33	\$1795	\$2395	\$2895	\$3395

Add \$200 to any price for a 128K cache.

We think you'll agree, a UL® listing says something not only about safety, but about quality as well!

In addition to all of these standard ZEOS advantages, you're also receiving our legendary ZEOS Technical Support, *24 Hours a Day, 365 Days a Year*. Plus, our 30 day Absolute Satisfaction Money Back Guarantee and more!

So pick your Power, and your Price then give us a call! Your expert ZEOS Systems Consultant is ready to answer any questions you may have. *Why not give us a call right now Toll Free at 800-423-5891.*

Purchase orders subject to approval. All prices and specifications are subject to change without notice. Please call to confirm pricing, specification and warranty details. Microsoft and Windows are trademarks of Microsoft Corporation. Z-Card, SpaceSaver and ZEOS are trademarks of ZEOS International, Ltd., 530 5th Avenue, N.W., St. Paul, MN 55112 USA © 1991.

INCREDIBLE ZEOS PACKAGE #3

Add even more memory, a larger drive. And more Savings! You now receive:

- 4 full Megabytes of Ultra High Speed 53ns DRAM.
- Our fast 130MB IDE hard drive with built in cache.
- Both Teac® floppies, the 1.2MB and 1.44!
- Your Diamond VGA Plus card with 1MB DRAM.
- ZEOS 14" High Res 1024 x 768 VGA Color Monitor with Tilt & Swivel Base.
- Plus, Microsoft® DOS, Windows and Mouse!

PACKAGE #3

THE ULTIMATE ZEOS PACKAGE #4

Now, Memory goes to 8MB and the drive to 210MB. The ultimate Power User's Dream Machine!

- 8 full Megabytes of High Speed 53ns DRAM.
- Your screaming 210MB IDE hard drive with its own built-in cache.
- Both Teac® floppies, the 1.2MB and 1.44!
- The Diamond Plus VGA color card with 1MB DRAM.
- ZEOS 14" High Res 1024 x 768 VGA Color Monitor with Tilt & Swivel Base.
- Plus, Microsoft® DOS, Windows and Mouse!

PACKAGE #4

CALL NOW TOLL FREE
800-423-5891

FAX Orders: 612-633-1325

Hearing Impaired (TDD):

800-228-5389

Govt. & Educ.: 800-245-2449

Outside US and Canada

Call: 612-633-6131

MasterCard, VISA, Discover,

Am Exp, Z-CARD, COD and

Leasing Programs.

Open 24 Hours a Day,

365 Days a Year!



Why ZEOS is Y

✓ Now, your ZEOS modular system allows you to upgrade from one CPU to another as your computing requirements change. Obsolescence is virtually obsolete!

✓ You may choose between a variety of '386 and '486 processor options, both cached and non-cached.

✓ Made in USA! Your new ZEOS system boards are designed and manufactured by ZEOS, right here in the USA.

✓ ZEOS has utilized the very latest in highly integrated surface mount technology. Faster, cooler, more reliable systems for you!

✓ Every ZEOS modular system comes standard with incredibly fast 53 *nanosecond* DRAM.

✓ Plus, you may expand your system with up to 32 megabytes of memory right on the motherboard.

✓ Your new system features the *exclusive* ZEOS seven bay desktop case, smaller than most five bay cases yet plenty of room for future expansion.

✓ Two whisper quiet cooling fans move more cool air thru your system increasing reliability and component life.

✓ Your *entire* system is UL* listed (not just the power supply). Few others offer this security; we wonder why.

CHECK YOUR EXCLUSIV

If you're deciding which new computer to buy, there are many important considerations.

Here, we've gathered together a number of these considerations for your review. Some are of obvious

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✓ Two high speed serial ports, one parallel port and one game port.

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ZEOS ADVANTAGES:

importance, while others are subtle yet critical to your ultimate satisfaction. We'll go over them here with you one by one.

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10 Good Reasons To Buy From ZEOS®

Reason #1

"Overall Excellence"

As *PC Magazine* said "Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but *eight* times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editor's Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed:

Excellent. Compatibility: Excellent. Value:

Excellent." *Personal Computing* said,

"ZEOS... is the best value we've come across... its performance is right up

there with the slickest, most expensive PCs you can buy."

Reason #5

Warranties and Guarantees.

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Reason #6

24 Hour Toll Free Technical and Sales Support.

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Reason #7

Experience.

Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

Easy to Buy.

ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, Discover, American Express, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

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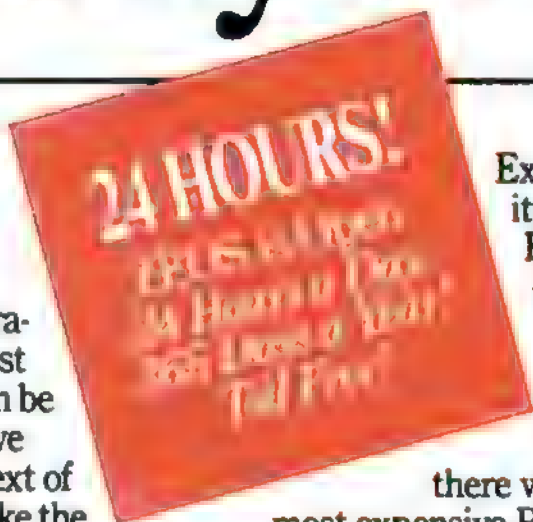
Reason #10

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When it comes right down to it, you're going to be very satisfied with your new ZEOS system. Our goal is your complete satisfaction. And that's our commitment to you. To quality. To performance. To reliability and support. To *Value*. We don't just say it, *we Guarantee it!*

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First Looks

Modular Designs Promise Long Life For Tandon and Amkly PCs

HANDS ON

By Walter L. Rosen

The more things change, the more you want to change your PC. Whether it's a new microprocessor, a new hard disk, or a more advanced display system, some technical innovation will inevitably make you long to upgrade your PC.

The processor on a card has been adopted by ALR, AST, and IBM, but Tandon and newcomer Amkly Systems have taken the concept even further, using modular designs that give you access to all major system components.

Apart from the basic concept, the two companies use entirely different approaches, from mechanical as well as marketing aspects.

Tandon gives you a design that's as easy as plug and play. Hard disk and processor modules easily slip into the chassis of the company's Option system. Processor upgrade choices range from a 16-MHz 286 to a 33-MHz 486, pausing in between for 20-MHz 386SX systems, with and without caches.

Amkly, on the other hand, puts its microprocessor on a proprietary expansion board and mass storage drives on a removable subchassis. One mi-

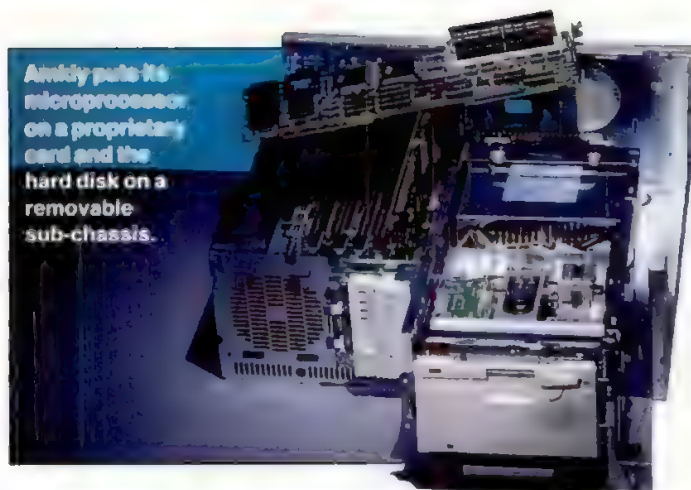
croprocessor upgrade is available, from a 25-MHz 386DX to a 25-MHz 486.

Though mechanically a less-radical approach, Amkly has a more innovative marketing strategy: If you trade in your old 386 board for a 486, you suffer no price penalty; your total cost will be the same as if you bought the 486 from the start. Tandon, on the other hand, has no trade-in policy at present.

Overall pricing gives Tandon the edge: You can buy a 286 or 386SX Option, upgrade to a 486, throw away the old module, and still come out ahead of the cost of the Amkly.

The list prices puts the top-of-the-line Amkly at \$6,000 without a hard disk; the 486 version of the Tandon would cost \$3,490 (\$995 for the required base unit to hold the module and \$2,495 for the 33 MHz). A 286 module costs \$795; a 386SX without a cache is \$1,165, and \$1,395 with cache.

This price comparison is not quite fair. The Amkly 25-MHz 486 uses an EISA expansion bus and puts 4MB of RAM inside as standard equipment. The 33-MHz Tandon 486 uses an ISA bus and comes with 2MB standard as well as a monochrome monitor, mouse, and Windows. Both include Super VGA graph-



ics, a high-density floppy disk drive (1.44MB or 1.2MB), DOS, a keyboard, and two serial and one parallel port.

Tandon puts its microprocessor in a 6- by 7.75-inch metal-cased cartridge just $\frac{3}{4}$ of an inch thick, which fits in a slot in the front of the chassis. To switch microprocessors, you press a couple of release buttons at the bottom of the case, and the plastic front fascia pops off, revealing the needed slot.

Fascia removed, you can also slide the 3.5-inch IDE hard disk out for upgrading, again without tools. Changing the floppy disks in the two 5.25-inch half-height bays and adding an internal hard disk to the system's 1-inch-high 3.5-inch bay will require opening the 5- by 18- by 16-inch (HWD) case with a screwdriver. Seven expansion slots are available for conventional upgrades; Three 16-bit and one eight-bit measure full length; three 16-bit slots are limited to 7-inch boards.

The one shortcoming of the Tandon design is memory. Because RAM is built into the system board, it doesn't change when you switch microprocessor modules. While the 16-bit memory interface is a perfect match for the 286 or 386SX modules, it shortchanges the 32-bit 486.

The 486's internal cache and Tandon's proprietary write-posting circuitry on the 486 module help minimize the performance hit. Even so, the Option is about 10 percent slower than more conventional systems with the same microprocessor, according to PC Magazine Labs tests.

The Amkly approach is both more and less conventional. The system microprocessor fits on a full-length, XT-height expansion board in a proprietary slot at the far left of the chassis. The board also holds memory, so the upgrade automatically includes the right bus width for memory. The six other expansion slots in the Amkly all follow the EISA 32-bit specification. Removal of the Amkly disk isn't entirely tool-free: A screw secures the assembly in place.

Taken together, both Amkly and Tandon highlight the latest direction in the computer industry—investment-preserving upgradable systems. Although neither can be an absolute assurance against obsolescence, these systems' favorable prices mean you can get a good measure of future flexibility with little penalty.

List Price: Amkly System: 386/25, \$3,700; 386/33, \$4,500; 486/25, \$6,000; upgrade from 386/25 to 486/25, \$2,300; 120MB hard disk, add \$900. Amkly Systems Inc., 60 Technology Dr., Irvine, CA 92718; 800-367-2655, 714-727-0788.

CIRCLE 703 ON READER SERVICE CARD

List Price: Tandon Option: base system, \$895; microprocessor modules: 286/16, \$795; 386/20 without cache, \$1,165; same with cache, \$1,390; 486/20, \$1,795; 486/33, \$2,495; 40MB hard disk, \$315; 80MB, \$345; 110MB, \$535; 200MB, \$725; 400MB, \$1,595. Tandon Corp., 405 Science Dr., Moorpark, CA 93021; 800-800-8850, 805-523-0340.

CIRCLE 704 ON READER SERVICE CARD



PHOTOGRAPHY: THOM O'CONNOR

First Looks

SuperStor Packs More Data On Disks, But Uses 53K RAM

HANDS ON
by Christopher Barr

Compression programs that shrink files when written to disk and then reconstitute them on the fly can add new life to your cramped hard disk. Using this approach, AddStor's *SuperStor* squeezes about 40 percent more data onto your hard disk. But it steals valuable RAM.

SuperStor creates a hidden file on your disk to hold the compressed volume. You can select an entire hard or floppy disk or disk partitions for compression.

We tested *SuperStor* on two machines: a 286-based IBM PC AT with a 30MB hard disk and a Dell 310 with a 100MB hard

disk. Both used DOS 5.0. On the 286, we converted the entire drive to a compressed disk, which, according to CHKDSK, yielded a total 62MB of disk space. On the 386, we compressed a 32MB partition that contained *Windows* and *Windows*' applications; this gave us a total of 66MB on the partition. In both cases the compression drivers took 53K of RAM.

Even though AddStor says you can load the *SuperStor* driver into high memory, it was too large to fit "high." AddStor claims that the next version of the product will have a smaller RAM requirement.

The driver is bloated because it adds buffers and caching to speed file compression

and decompression. Compared with the software version of *Stacker* (see First Looks, March 12, 1991, pg. 38), *SuperStor* is faster at DOS file access and writing files to disk. But *Stacker*'s driver used only 30K of RAM on the 286 and 38K on the 386. We were also able to load *Stacker* into high memory on the 386.

Another drawback to both is loss of speed when writing to disk. Disk writes take longer because of the overhead generated by the compression algorithm. Yet according to PC Labs benchmark tests, most disk access file reads are actually faster with *SuperStor* because there is less data to search through.

Compression ratios vary based on the nature of your files. Text, database, spreadsheet, and some graphics files can compress more fully than executable and binary files.

Compatibility with existing utilities posed no problem for *SuperStor*. We could still use

popular utilities including *PC Tools* and *The Norton Utilities*. But AddStor recommends that you avoid using third-party disk defragmentation modules; these may undo *SuperStor*'s tightly woven file structure. And although you cannot use it with DR DOS 5.0, *SuperStor* is safe for SCSI, ESDI, and IDE drives, as well as Bernoulli boxes and floppy disks.

Using a disk compression driver like *SuperStor* makes sense on notebook PCs where replacing the hard disk is difficult. But on a desktop PC, considering that you gain just 40 percent more disk space but lose a whopping 53K of RAM and get slower disk writes, you'd probably be better off buying a bigger disk.

List Price: *SuperStor*, \$129.

Requires: 1MB disk space, 640K RAM, DOS 3.2 or later. AddStor Inc., 3905 Bohannon Dr., Menlo Park, CA 94025; 415-688-0470.

CIRCLE 432 ON READER SERVICE CARD

Nikon Scanner Generates TIFF Images at 6,144 by 4,096

HANDS ON
by Winn L. Rosch

Ask any photojournalist why he or she uses a Nikon camera, and you'll get your ear chewed off about "quality" and "complete systems." The same reasonings apply to Nikon's LS-3500 slide scanner, just released in a PC-compatible package with U-Lead Systems' *Windows*-based *PhotoStyler* (see First Looks, June 25, 1991). (U-Lead was recently acquired by Aldus.)

The \$10,495 scanner converts 35-mm. slides and negatives (color or black-and-white), into electronic file formats such as TIFF.

The Nikon is the first scanner with sharpness and color fidelity beyond the capability of today's films. While other slide scanners strain to resolve 1,000 lines, the LS-3500 produces 6,144 by 4,096 pixels. That's more than double the 80 lines per millimeter produced using the best photo equipment.

The LS-3500 is part of a

complete Nikon Image Management System: a computerized image-handling system that has a high-definition electronic still camera, a direct telephoto transmitter for zipping reproduction-quality images across continents, and a dye-diffusion printer, the CP-3000.

Couple the \$13,595 Nikon printer to your PC/LS-3500 combo, and you'll see new light in darkrooms. You can make prints and enlargements com-

pletely electronically—1,290-by-1,024 pixel resolution across its A5 (6.3- by 5-inch) paper size in 16.7 million colors (thanks to thermal sublimation dye-diffusion technology).

To use the scanner, you simply slip the film into the breadbox-sized scanner, and use *PhotoStyler* to begin the scan. Line by line, a reproduction-quality image appears on your screen ready for editing or enhancement. The scanner is connected to your PC via either a serial or GPIB (General Purpose Interface Bus).

The downside to the LS-

3500 is the prodigious amount of data it generates: A highest-resolution color scan of a full 35-mm. slide totals 72MB and generates a disk-based temporary file of that size.

Moreover, the system can be sensitive to your PC's condition. One high-res scan took 4 hours, against Nikon's claimed 18 minutes. The long scan was attributed to a small, fragmented hard disk. Nikon recommends at least 300MB.

For most purposes, excellent results are produced at one-third the top resolution, creating files of about 6MB. Compression can squeeze a finished file of that resolution into 200K or so of disk space with relatively little image loss.

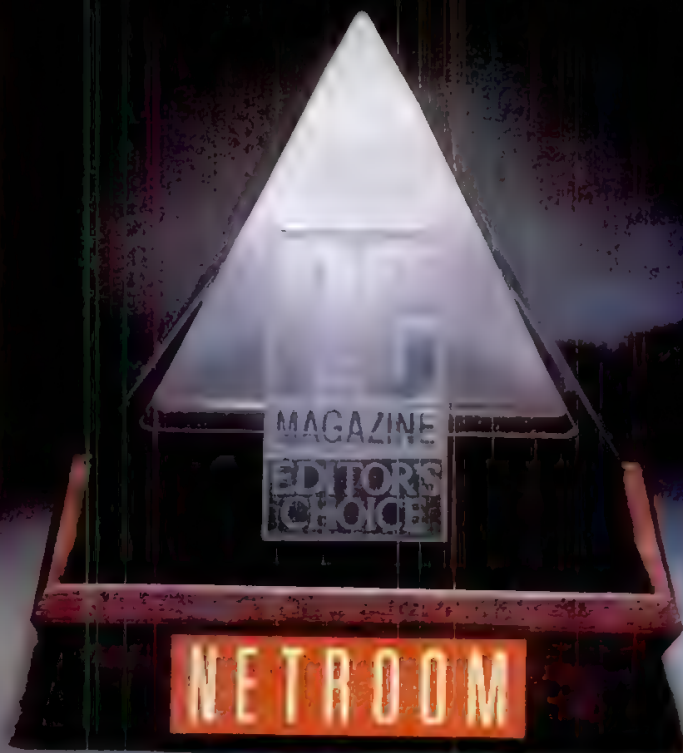
If you need the utmost in quality for making color separations, storing, or transmitting art, you'll find the LS-3500 leagues ahead.

List Price: LS-3500 slide scanner, \$10,495. **Requires:** 386-based PC or better, 2MB RAM, *Windows* 3.0. Nikon Electronic Imaging, 1300 Walt Whitman Rd., Melville, NY 11530; 516-547-4200.

CIRCLE 431 ON READER SERVICE CARD



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Relocates to LIM 3.2 frame	✓		
Relocates to Expanded	✓		
Relocates to Extended	✓		
Works on 386/486	✓	✓	✓
Works on 8088/286	✓		
Memory Analysis Utility	✓		

*Requires NEAT CHPSet on 286 systems.

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First Looks

Arts & Letters 3.1 Pours on New Features, Designer 3.1 Pours on the Speed

HANDS ON
by Gary Kaplan

Chili isn't the only thing that's hot in Texas. So is the competition between the two popular vector-based drawing products made in the state: *Arts & Letters* and *Micrografx Designer*.

The two products recently underwent performance upgrades with the same statistics: Both are Version 3.1, both are priced at \$695, and both are aggressive attempts to wrest market share from *CorelDRAW* 2.0.

Arts & Letters (A&L) and *Designer* use similar interfaces and toolboxes, and although A&L has always been judged easier to learn, *Designer* is moving in that direction by offering a customizable toolbox.

While *Designer* has added speed, A&L has added more new features, including warping, gradient fills, and charting.

The warp feature, which manipulates an image within a spatial envelope, is much easier to use than *CorelDRAW*'s enveloping. You customize a warp by selecting parameters that include symmetry and orientation, then compress or stretch the envelope's contents.

A&L's new gradient fills are a lot easier to use and offer more extensive options than does *Designer*'s.

In a radical move, A&L adds data charting. Currently it is the only illustration package on the market to support charting. While the charting is elementary (it includes support for data import and export), it should satisfy a designer's basic needs.

Other A&L additions are cosmetic. There are cascading menus, new color editing icons in the toolbox, and color samples in the color dialog box. More important, A&L adds support for third-party fonts, something *Designer* has had all along.

Another A&L improvement is better use of memory. Also,



Arts & Letters' new warping feature lets you manipulate objects within a defined space. A pop-up menu offers a preview of all ten warp shapes.

both the number of objects in a file and the number of points in an object have been increased. And the clipboard now lets you paste an object in front or behind any selected object.

Like previous releases of *Designer*, A&L now has quick display options. One-upping *Designer*, it now offers a bitmap display and shows fills, show wide-line styles, and display gradient toggles. In contrast, *Designer* offers only two display options, which either turn complex fills on or off, or display in a wireframe mode.

Designer adds a number of new features, but its focus is primarily on performance. Two new features, object blend and "text along a path," are both already part of the A&L and *CorelDRAW* feature set.

Designer's object blending is easy and reliable. You can transform one object or color into another by selecting "starting" and "ending" objects and specifying the number of steps in between. But A&L's ability to change the step number and recalculate the blend is a useful feature that *Designer* still lacks.

Micrografx did a nice job implementing text placement on

a path. Once the text is placed, it can be converted into a "reshape text" mode, which allows you to move the starting point with the mouse. This offers you more freedom than A&L or *CorelDRAW*.

The latest version also adds 256-color support on-screen. Bitmap color separation and a quicker-than-ever redraw make working with scanned images much easier. Bitmaps can now be clipped as mask symbols or

used as custom pattern fills.

Designer 3.1 also adds a square gradient fill, as well as import and export filters for .WPG, EPS, and AI. Improved outline fonts, various wide-line styles, and on-screen kerning boost its performance.

Most of *Designer*'s upgrade efforts went into improving text speed, gradient and symbol fills, and object-masking redraw speeds. Screen redraws in this version are about twice as fast as before, making *Designer* the quickest illustration package. Coupled with this are optimized drivers for PostScript and PaintJet printers and the Matrix Film Recorder.

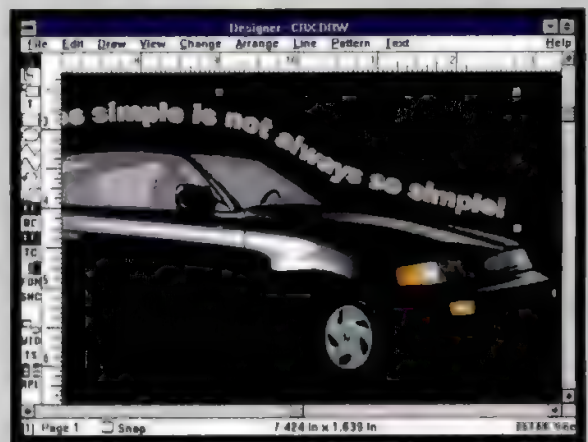
It's gratifying to see that both companies continue to refine their products. *Arts & Letters* remains the easiest-to-use illustration product for the PC, due in part to its huge selection of bundled clip art. *Designer*, on the other hand, continues to be the best technical rendering program.

List Price: *Arts & Letters*, Version 3.1, \$695. **Requires:** Microsoft Windows 3.0. Computer Support Corp., 15926 Midway Rd., Dallas, TX 75244; 214-661-8960.

CIRCLE 490 ON READER SERVICE CARD

List Price: *Micrografx Designer*, Version 3.1, \$695. **Requires:** Microsoft Windows 3.0. 386-based PC and 2MB RAM recommended. Micrografx Inc., 1303 Arapaho, Richardson, TX 75081; 214-234-1769.

CIRCLE 700 ON READER SERVICE CARD



Designer's new features include blended objects and color and the ability to place text along a path.

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—David Hess, Executive Director, Environmental Resources and Energy Committee, Pennsylvania Senate

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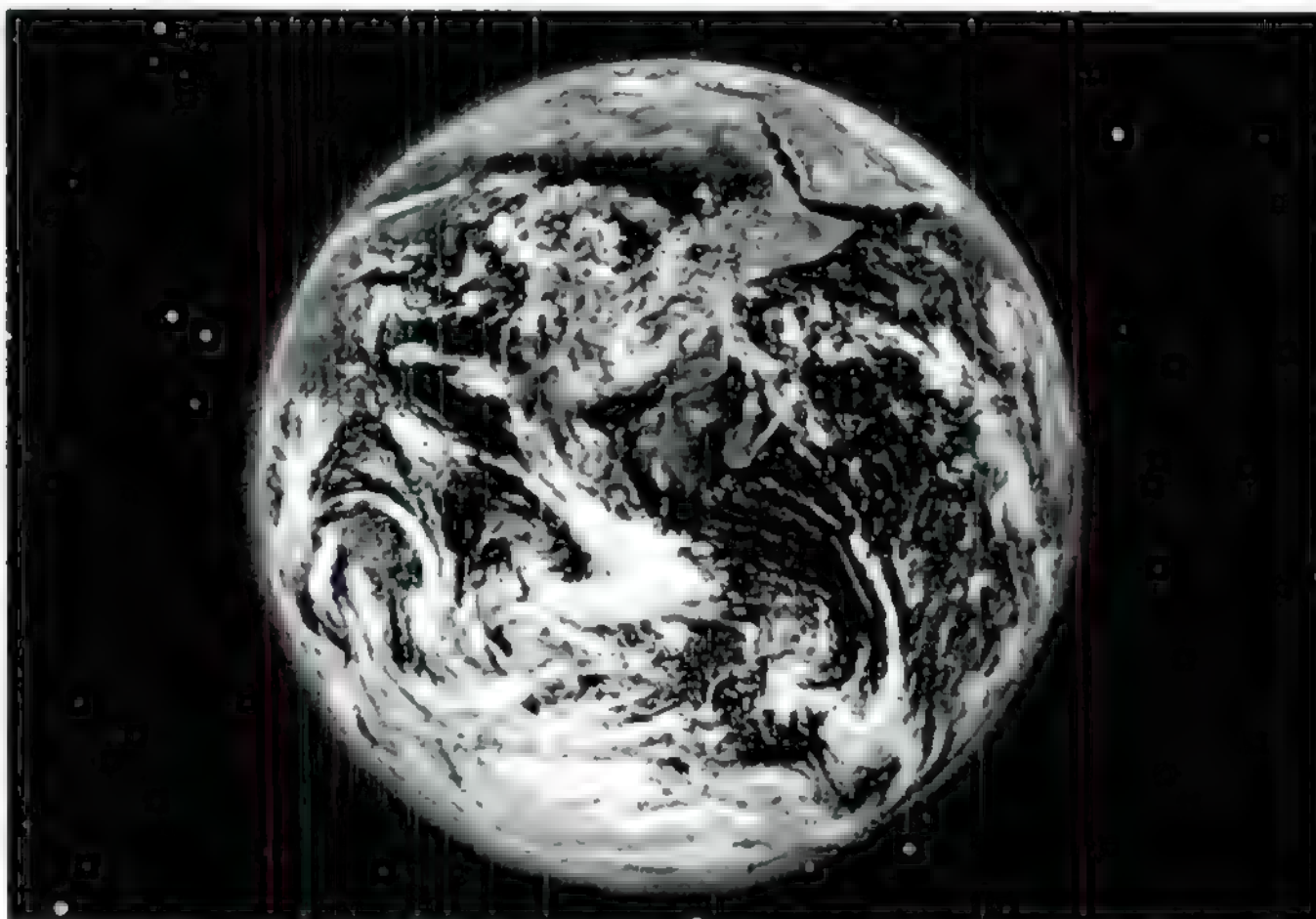
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* The Panasonic KX-P1124. Based on US dollar share of competitive models for the 12 months ending December, 1990, as reported by InfoCorp. (1/91).

First Looks

NEC Lowers Cost of Color Output with Colormate PS 40

HANDS ON
by MITT JONES

Of course, it's not fair. The gang in graphics arts finally land a \$9,000 color PostScript printer, and move it so frequently you have to hunt it down.

NEC Technologies hopes to provide a bit of relief in the form of the \$6,995 NEC Colormate PS Model 40 printer, a high-quality color thermal-transfer model priced to appeal to the presentation graphics market.

The Colormate PS 40 comes in the same chassis and uses the same praiseworthy, 300-dpi engine as the \$8,995 NEC Colormate PS Model 80 (see "Color Page Printers: Putting a Rainbow on Your Desk," December 25, 1990). The engine, designed and manufactured by NEC, produces any of 16.7 million colors when using its 4-color cartridge.

NEC achieved the lower

price by paring down memory from 8MB to 4MB and Adobe font outlines from 35 to 17. You still get the complete set of Courier, Helvetica, and Times.

A more important limitation concerns the amount of information you'll be able to print on any one page. Like the Colormate PS 80 before it, the PS 40

can print color graphics over an area of 8.1 by 9 inches using letter-sized paper, but the 4MB drop in printer memory will result in a substantial reduction in the size and complexity of your printed images.

A simple report with a bar chart or two shouldn't cause any problems; a full-page graphic with gradient fills and pin-wheeled text is out of the question. And unlike the Colormate PS 80, the Colormate PS 40 cannot accommodate legal-sized paper.

The Colormate PS 40's graphics speed matches its 8MB

predecessor, printing our test sample at a rate of 0.55 graphics pages per minute. The printer fared considerably worse on text speed, printing at 1.7 pages per minute versus the Colormate PS 80's 2.8 ppm.

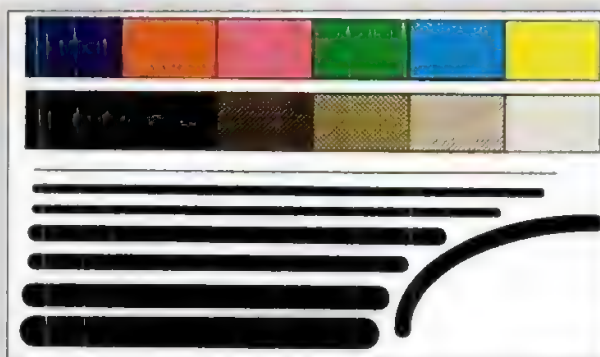
In a thoughtful touch, NEC has provided an upgrade path for the Colormate PS 40 via a \$2,000 upgrade to the Colormate PS 80. It comprises of two daughterboards that install on the integrated controller.

Both units come with a \$90 four-color cartridge and also accept NEC's \$90 three-color and \$86 black cartridges. The treated paper you must use costs \$35 per 500-sheet pack.

The NEC Colormate PS Model 40 produces color output every bit as impressive as that of NEC's top-of-the-line \$8,995 Colormate PS 80. Its capabilities and \$6,995 cost simply fall more in line with the requirements of the typical business user than the graphic artist. ■

List Price: NEC Colormate PS Model 40, \$6,995. NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; 800-632-4636, 508-264-8000.

CIRCLE 430 ON READER SERVICE CARD



The NEC Colormate PS Model 40 uses thermal transfer to generate images at 300 dpi in up to 16.7 million colors.

Everything You Need to Adjust Your Video Hardware for \$79

HANDS ON
by JAMES KIRNEY

DisplayMate is for anyone who wants to get the very most from a video card and monitor subsystem. It offers a full series of hardware tests and an excellent manual that tells you everything you need to know about the operation of almost any monitor-and-adaptor-card combination, even if you don't know precisely what to ask.

Installing and using the program is easy despite its technical sophistication. Sonera Technologies' *DisplayMate* has two modes: an automatic nontechnical suite of adjustments and diagnostics and a more powerful technical series. Both methods follow a logical progression: adjust the display's contrast and brightness, then run a Video

Obstacle Course. Depending on your configuration, a series may have more than 300 tests and evaluation screens.

DisplayMate can also be used to tune and evaluate projection systems and even TV sets (with a composite video card). While the current version

is limited to MDA through VGA, future releases that will offer tests for 8514/A, Super VGA, and Texas Instruments 340X0-based cards with 24-bit color are planned.

Don't expect your card and monitor to pass all the challenges because, as with any good test, the idea is to find weaknesses. Some faults show up because existing hardware is not up to the task; others are due

to cost-cutting by the vendor. Some tests will point out adjustments or repairs that should be performed.

For example, we noticed that in our office, all the multi-switching monitors had trouble when changing modes, and LCDs had noticeable streaking. *DisplayMate*'s on-line help and the manual offer explanations of the tests and recommend possible action if a component fails to make the grade.

The \$79 price is a real bargain for software that can help you choose, test, adjust, and maintain a key computer component—and increase the comfort of using your computer. ■

List Price: *DisplayMate*, Version 1.1, \$79. **Requires:** 512K RAM; MDA, CGA, EGA, MCGA, VGA, or Hercules-compatible display. Sonera Technologies, P.O. Box 565, Rumson, NJ 07760; 800-932-6323.

CIRCLE 440 ON READER SERVICE CARD



DisplayMate's test pattern allows testing of aspect ratio, distortion, intensity, and color balance.

First Looks

Oracle Card Brings Stack Programming to SQL Data

HANDS ON
by Bob Alresian

Openness and portability are the key words in Oracle Corp.'s multiplatform relational database management system (RDBMS) strategy. The plan is to allow users in mixed computing environments equal access to *Oracle* data regardless of whether they're Mac or PC-centric. The first foray into *Windows* is supported by *Oracle Card* and *Oracle for Windows*. Future products will support other platforms.

The \$399 *Oracle Card* lets you build a *Windows*-based graphical front end to *Oracle* data. The product is based on technology licensed from Spinnaker Corp.'s *Spinnaker Plus for Windows*. Both *Plus* and *Oracle Card* are compatible with *HyperCard* 1.2 on the Mac, so applications created with *Oracle Card* will run without modification on the Mac platform.

Oracle Card combines *HyperCard*-like functionality with the ability to make data requests

from a local or remote *Oracle* database. It uses a "stack" and "card" metaphor to quickly build applications.

Stacks are the equivalent of applications; a sequence of linked cards makes up a stack. Each card can possess actions and directions of movement as well as static and editable fields, buttons, and graphics objects.

Oracle ships with four stacks that are central to the operation: The Stack Builder lets users build *Oracle* applications by using a mouse to link screen objects such as buttons, fields, and windows with database objects and operations. Query Builder is a report generator. Table Builder creates, manages, and lets you view the structure of remote database tables. The User Preference stack lets you specify preset options.

Painting and drawing tools are available to create the interface. Other options include implementing data security, setting display formats for dates and numbers, displaying confirmation messages, and linking



A card that can contain buttons, fields, and graphics objects in a single window creates a graphical front end to an *Oracle* RDBMS in the client/server environment.

fields and buttons with database columns and SQL operations.

Cards and their elements are built from tools contained in an icon toolbox. The toolbox is a boon for creating quick cards, because it automatically displays the appropriate tools as you change among *Oracle Card*'s different contexts: stacks, cards, fields, buttons, and graphics objects.

Oracle Card can create two types of stacks: Standard and Custom. Standard stacks are easy enough for nonprogrammers to create, because they use the built-in database functionality provided by *Oracle Card*.

Custom stacks can be exceptionally powerful, but they rely on building an application using *OracleTalk* and *Oracle Access*, both of which are included.

OracleTalk is the scripting language for *Oracle Card* objects. Each object's script code contains "handler" modules that process event messages particular to an object. *OracleTalk* also supports external functions that extend the language via *Windows*' DLLs.

Oracle Access provides the interface between SQL primitives and *OracleTalk*.

Cards support single-row and multirow data processing. Processing refers to the ability to execute SQL database operations: select, insert, update, and delete. However, multirow processing is limited to a read-only mode, thus only select SQL operations are allowed.

Multiple database table JOINS are also supported through a master/detail relationship. A master card does single-row processing on one database

table and it acts as the key for the processing on other cards. These other cards contain the detail information related to the key fields that are associated with other database tables.

Oracle Card has a few problems, most notably that the presentation of list boxes doesn't conform to the *Windows* standard. Dragging an object across the screen is slow within *Oracle Card*, and there are no custom-defined menu objects.

Oracle Card does not support DDE or MDI (Multiple Document Interface). It is not possible to open multiple cards or stacks concurrently. Nor will *Oracle Card* run in *Windows*' Real mode. *Oracle for Windows* uses DDE to link *Oracle* data with other *Windows* programs but doesn't run stacks.

The worst omission is the lack of a runtime component. If you develop your own stacks and want to distribute them, each person who wants to run your stack will have to have a copy of *Oracle Card*—and that's not open or portable. ■

Oracle Reaches Excel and Ami Pro

Oracle for Windows lets *Windows* application users incorporate *Oracle* data. It combines the *ToolBook* interface with a DDE Manager that provides data access between *Oracle* and DDE-supporting *Windows* applications such as *Excel*, *Ami Pro*, *Word*, and *Wingz*.

Users can build and run ad hoc queries using a "point and shoot" Query Builder that's included in the DDE Manager. *Windows* applications can establish live SQL data links with any *Oracle* server, and send SQL statements to single or multiple *Oracle* databases on any of *Oracle*'s support-

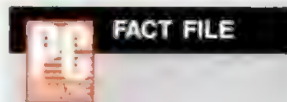
ed computing platforms.

As we went to press, *Oracle* Corp. announced three new precompilers for C, COBOL, and FORTRAN, as well as an *Oracle for 1-2-3 DataLens*, as part of a commitment to supporting *Oracle* applications development in all environments.

—Robin Raskin

List Price: *Oracle for Windows/ToolBook Interface*, \$299. **Requires:** 3MB RAM, 2MB hard disk space, *Windows* 3.0. *Oracle* Corp., 500 Oracle Pkwy., Redwood Shores, CA 94065; 800-633-0598, 415-506-7000.

CIRCLE 716 ON READER SERVICE CARD



FACT FILE

Oracle Card 1.0

Oracle Corp., 500 Oracle Pkwy., Redwood Shores, CA 94065; 800-633-0598. List Price: \$399.

Requires: 286-based PC or better, 2MB RAM, Microsoft *Windows* 3.0, DOS 3.1 or later.

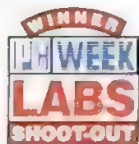
In Short: A powerful hyperprogramming environment with great graphics and client/server data access to an *Oracle* RDBMS.

CIRCLE 709 ON READER SERVICE CARD



One Of The People Working Here Is Wearing Pajamas.

Now you can leave the office without a single disk and not even think about what you're going to work on until you switch on your home PC. At three in the morning. In your polka dot pj's.



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Commute[™] lets you access everything on your office PC from your home PC or laptop over a modem or Novell network. We're talking about taking control of your office PC from anywhere at anytime without getting in a car, on a plane, or off your bottom.

Commute lets you run DOS and Windows-based applications, transfer files, access E-Mail,

and use the laser printer in your office from home, a hotel, anywhere. All with complete security.

And the hardest part of using Commute is opening the shrinkwrap. There are simple pull-down menus, on-screen help and mouse support. There are even pictures on the screen to tell you what to do.

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Of course, either way, you will have to get dressed.



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Making Computing Safer, Simpler, Faster.

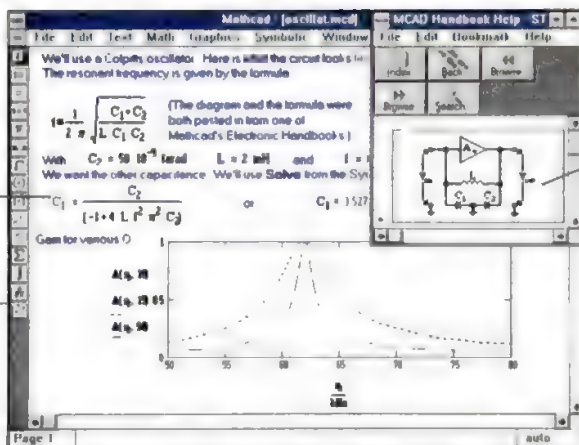
Central Point Commute, Commute and PC Tools are trademarks of Central Point Software, Inc. Names of other products mentioned herein are used for identification purposes only and may be trademarks and/or registered trademarks of their respective companies. Offer good in U.S. and Canada only.CIRCLE 162 ON READER SERVICE CARD

How to spend less time thumbing through books and more time thumbing through results.

New Mathcad 3.0

New Mathcad 3.0 crunches, graphs, updates, and documents your work in real math notation. Automatically.

New symbolic capabilities are available with a simple menu pick.



New Windows 3.0 interface makes calculation fast and effortless.

New Electronic Handbooks give instant access to hundreds of standard formulas. Just click 'n' paste.

It's the fast, efficient, comprehensive way to do technical calculations.

Move those reference texts off your desk. Put that calculator back in your pocket. And save that cryptic spreadsheet for your budgets and bookkeeping.

It's time to get problems out of the way and make room for answers. With new Mathcad 3.0, the major new upgrade to the world's best-selling math software.

It's the all-in-one solution with a singular purpose: to put results in your hands as quickly and thoroughly as possible.

New Mathcad is a workhorse that handles everything from simple sums to matrix manipulation. Effortlessly, naturally.

Simply type your calculations into the live document, just like you'd write them on a scratch pad. And let Mathcad do the work for you. It performs the calculations. Graphs in 2-D or 3-D. Automatically updates results each time you change a variable. And prints out presentation-quality documents, complete with equations in real math notation, even scanned-in graphics.

Newly upgraded Mathcad 3.0 now has Electronic Handbooks for instant access to

hundreds of standard formulas, useful data, even entire calculations. Just click 'n' paste them from a hypertext window into your documents, ready to use.

When you need to simplify a formula, Mathcad's symbolic calculation capabilities are available with a simple menu pick.

There's no arcane programming language to learn, so you can do integrals, Taylor series, infinite sums, and more—all with point 'n' click simplicity. The symbolic answer can be used for both numerical calculations or further symbolic transformation.

You'll also find improved equation editing, enhanced graphing features, and more documentation options. So why waste time working with problems? Join the

120,000 users that get results—with Mathcad.

- New easy to learn and use Microsoft Windows 3.0 interface
- New easy to use symbolic calculations
- New Electronic Handbooks with hundreds of built-in solutions
- Optional Applications Packs with adaptable templates for Electrical, Mechanical,

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1-800-MATHCAD

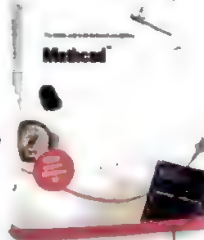
*Free upgrades available for those who purchase Mathcad 2.5 for DOS from 5/1/91-6/30/91. Call for details.

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Best of '87



by
**Cristina Córdova
and Nate Zelnick**

New & Improved

News of Announced Products and Upgrades

Tektronix Printer Uses Solid Ink to Match PostScript 2 Colors

NEW The new Tektronix PhaserJet PXi, one of the first printers to generate PostScript Level 2 color images, employs a new solid-ink design. Wax-based ink pellets, much like crayons, are melted onto virtually any medium, from tracing paper to card stock. The maximum print area is 11.6 by 17.6 inches, allowing full-bleed images on 11- by 17-inch paper.

The \$9,995 printer can be connected to Macs, PCs, and Unix workstations; it is compatible with PostScript 1 and 2 as well as HPGL. The device-independent color matching in Adobe's PostScript Level 2 software allows you to specify colors to CIE-based international standards. Color simulations and TeleColor Pantone color-matching technology add to the printer's color control capabilities.

The 300-dpi printer has its own 24-MHz RISC-based controller, 10MB of RAM (ex-



The Tektronix PhaserJet PXi uses wax-based ink pellets to generate PostScript Level 2 or HPGL color images.

pandable to 18MB), and 39 resident fonts. **List Price:** Tektronix PhaserJet PXi, \$9,995. Tektronix Inc., 1720 W. Detweiller Dr., Peoria, IL 61615; 800-835-6100, 503-682-7377.

CIRCLE 434 ON READER SERVICE CARD

QMS Debuts Color Thermal PostScript Printers in Two Sizes

NEW QMS has introduced separate color PostScript Level 1 printers for oversize and standard letter-size documents.

The \$6,995 QMS ColorScript 100 Model 10p comes with 4MB RAM and prints at letter size on paper or transparencies.

Designed for the needs of desktop publishing, the \$12,995 Model 30si supports 11.75- by 19.3-inch, 11- by 17-inch, and letter-size paper and transparencies. It can bleed images to the edge of an 11- by 17-inch page and comes with 12MB of RAM.

Both printers use a 16.67-MHz 68020 controller, print at 300 dots per inch, and have 35 resident typefaces.

List Price: QMS ColorScript 100 Model 10p, \$6,995; QMS ColorScript 100 Model 30si, \$12,995. QMS Inc., One Magnum Pass, Mobile, AL 36618; 800-631-2692, 205-633-4300.

CIRCLE 435 ON READER SERVICE CARD

HOT PROSPECT

PETER NORTON BRINGS ALL HIS UTILITIES TO WINDOWS IN ONE \$149 PACKAGE

The Norton Desktop for Windows combines the features found in Symantec Corp.'s three utility programs for DOS (*The Norton Utilities*, *The Norton Commander*, and *The Norton Backup*) and adds a few new ones. The \$149 program is actually a package of programs that can be used as a replacement for the Windows File Manager and Program Manager.

The fundamental data-recovery options in *The Norton Utilities* (file unerase, disk unformat) are run by clicking on an icon, or by running a special emergency disk that runs without Windows.

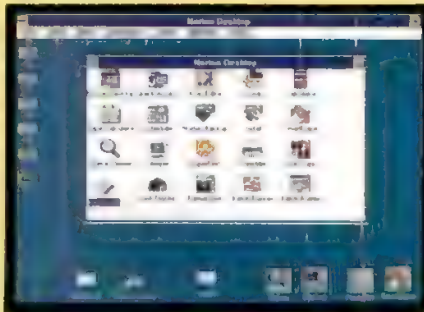
The file management features of *The Norton Commander* (moving, copying) are performed graphically in a format that replaces the Windows File Manager.

And *The Norton Backup* features can be run either as a Windows program or automated, using a built-in scheduling option.

In addition, *The Norton Desktop* has a host of other utilities, including text search, batch programming, icon editing, and screen saving with password protection.

List Price: *The Norton Desktop for Windows*, Version 1.0, \$149. **Requires:** 1MB RAM, 4MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0. Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; 408-253-9600.

CIRCLE 433 ON READER SERVICE CARD



Copy, move, view, launch, delete, and print files by simply dragging and dropping icons.

NTSC Video Board Does Real-Time Compression for \$3,995

NEW A two-board set from Fluent Machines provides video capture and real-time compression and decompression, using an Intel 960 RISC controller, for \$3,995.

One of the boards is a frame grabber with overlay; the second provides the compression and decompression. Together these VSA-1000 boards can store a quarter-screen of NTSC video, captured at 30 frames per second, in about 11MB of disk space. The design is scalable, so slower sampling rates can be used to reduce disk storage.

The proprietary software, *FluentStreams*, manages video and audio processing under Microsoft Windows.

The Fluent products allow developers to integrate full-motion digital video and synchronized audio into standalone and networked applications running Windows.

List Price: Set of two VSA-1000 boards, \$3,995; *FluentStreams*, \$495. **Requires:** Microsoft Windows 3.0. Fluent Machines Inc., 1881 Worcester Rd., Framingham, MA 01701; 508-626-2144.

CIRCLE 436 ON READER SERVICE CARD

BRIEFS



HARD DRIVES

SyDOS, a division of Syquest Technology, is making the SQ5110 available to the DOS world. This 5.25-inch half-height removable-cartridge disk drive has an 88MB capacity. An internal version costs \$1,998, and an external sells for \$2,298. According to Syquest, the drive has an average access time of 20 milliseconds and incorporates 32K buffers to support transfer rates up to 4MB per second. The SQ5110 has a fully embedded SCSI controller and provides asynchronous and synchronous SCSI bus data transfers. Also available is the 44MB SQ555 drive. 407-998-5400.

OCEAN Microsystems is shipping a new family of 88MB removable-cartridge drives. The Voyager 88 series, featuring Syquest's SQ5110 drive, supports DOS 3.3 and later, SCO Unix, and Xenix. Prices are \$1,375 to \$3,475 depending on the configuration. 408-374-8300.

Peripheral Land Inc. (PLI) has released an 88MB removable-cartridge drive based on Syquest's technology. The \$1,799 Infinity 88 Turbo drive supports SCSI-1 and SCSI-2 standards but requires a SCSI controller card. The drive can read from but not write to the original Infinity 40 Turbo cartridges. 800-288-8754, 415-657-2211.



HARD DISK MANAGEMENT

Maxi-Soft has announced **Maxi-Cat**, a \$59 program that stores frequently used data on a hard disk while keeping track of seldom-used data on floppy disks. It frees space on one or more hard disks by offloading files to floppy disks and extending the hard disk DOS directory to those disks. Whenever an application needs an offloaded file, **Maxi-Cat** will pop up a window with the ID of the floppy on which the file resides. 415-333-7495.

International Microcomputer Software Inc. (IMSI) has developed **MenuDirect Gold**, a \$79.95 program that provides menuing, password-protection, and usage-tracking features. An optional swap mode allows the program to run as a TSR occupying 8K of RAM. **MenuDirect Gold**'s file manager offers six sort options, three file-display options, file

CONTINUES ON PAGE 64

PageAhead Prepares Oracle and dBASE Files For PageMaker Use

NEW PageAhead Software Corp. has developed a *Windows* tool to simplify the printing of large databases with Aldus Corp.'s *PageMaker*. The \$795 database publishing program links *PageMaker* with mainframe, mini-, and microcomputer database management systems.

PageAhead retrieves data from *Oracle* and *dBASE* files, and provides tools to format and arrange the data so that it can easily be poured into *PageMaker* documents. It uses a spreadsheet-like interface and contains 60 database-publishing features, including heading control, style alterations, text replacement, capitalization control, and typographical sorting. **List Price:** *PageAhead*, \$795. **Requires:** 2MB RAM, *Microsoft Windows* 3.0, *PageMaker* 3.01 or 4.0. PageAhead Software Corp., 2125 Western Ave., #300, Seattle, WA 98121; 206-441-0340.

CIRCLE 437 ON READER SERVICE CARD

\$169 Audio Card Plays 8-Bit Sound

NEW Media Vision has introduced a \$169 8-bit sound card aimed at the game and multimedia markets. The Thunderboard is a low-end version of its Pro AudioSpectrum.

The Thunderboard provides 11-channel mono playback by using a single 8-bit Yamaha digital-to-analog converter (DAC), as opposed to the stereo that most higher-end cards achieve by using two DACs. Hardware-based file compression offers real-time rates of up to 4:1.

According to Media Vision, the Thunderboard is compatible with AdLib and Sound Blaster audio drivers. The board has standard joystick, volume control, microphone input, and stereo-out ports.

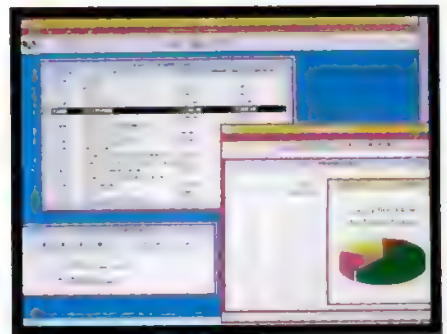
List Price: Thunderboard, \$169. **Requires:** 8-bit AT slot. Media Vision, 47221 Fremont Blvd., Fremont, CA 94530; 800-348-7116, 415-770-8600.

CIRCLE 438 ON READER SERVICE CARD

Quest Simplifies Access To SQL Data Files from Windows Applications

NEW Quest, Gupta Technologies' data-retrieval and reporting tool, is designed to provide quick access to SQL and *dBASE* data files from *Windows*. The \$495 program requires no knowledge of Structured Query Language (SQL).

By pointing and clicking on items in pull-down menus, you can create, edit, and browse SQL tables, issue queries, and build WYSIWYG



Quest's DDE support lets you move SQL data into other Windows applications.

reports against data without any programming knowledge.

The program's built-in DDE (dynamic data exchange) support allows you to transfer data from *Quest* to other *Windows*-based application programs, such as *Microsoft Excel* and *Wingz*.

Gupta packages the program with a single-user SQLBase engine, which enables *Quest* to be useful on standalone PCs as well as PC networks. No extra software is needed to use *Quest* with *SQLBase Server*, but special connectivity modules will be needed for *DB2*, *Extended Edition Database Manager*, *Microsoft's SQL Server*, *Novell's NetWare SQL*, *Oracle*, and *OS/2*.

List Price: *Quest*, \$495. **Requires:** 2MB of RAM, DOS 3.1 or later, *Microsoft Windows* 3.0. Gupta Technologies Inc., 1040 Marsh Rd., Menlo Park, CA 94025; 800-876-3267, 415-321-9500.

CIRCLE 439 ON READER SERVICE CARD

\$80 Utility Merges Database Files with Word Processor Files

NEW *MergeMaster*, a \$79.95 software utility from *Stairway Software*, produces word processor merge files from *dBASE* and *Paradox* databases.

After you select a *dBASE* or *Paradox* database, *MergeMaster* displays the names and types of all fields in the database file. You then mark the fields you want translated, select a word processing format, and name the resultant merge file. *MergeMaster* then creates the merge file.

The program supports *DisplayWrite* 3 and 4, *Microsoft Word*, *PFS:Professional Write*, *Volkswriter* 3, *WordPerfect* (4.2, 5.0, and 5.1), *WordStar* (3.0 and later), *XyWrite III*, and ASCII formats.

List Price: *MergeMaster*, \$79.95. **Requires:** 384K RAM, DOS 2.0 or later. *Stairway Software Inc.*, 700 Harris St., #204, Charlottesville, VA 22901; 800-782-4792, 804-977-7770.

CIRCLE 440 ON READER SERVICE CARD

CONTINUES ON PAGE 64

dWindows!

(from Borland)



VISUAL APPLICATION CREATION



Borland's new ObjectVision™ lets you create Windows applications that directly access dBASE files. Now it's easy to get the graphical Windows environment you want *and* access to your dBASE files. And developing ObjectVision applications is fast because there is *no programming required*.

ObjectVision transparently connects to all of your corporate data including Paradox®, Btrieve and ASCII files, as well as to other Windows applications via DDE. You can even access Paradox and dBASE files in the same multiuser environment making it the ideal Windows front end for all your data.

ObjectVision.

The power of visual programming.

Creating an attractive forms user interface is easy using ObjectVision's visual programming. You simply draw the elements of your application on the screen using ObjectVision's WYSIWYG graphical tool. Add the program's underlying logic by drawing intuitive decision trees. Then, as simple as a mouse click, create data links to connect the fields in your

application with the fields in your database. It's that simple. And that powerful.

All of ObjectVision's applications are developed incrementally, like a spreadsheet. So when you add new logic, or modify an object, you see results *instantly*. There's no waiting through an edit/compile/test cycle.

No extra royalty fees with ObjectVision Runtime!

For a one-time price of \$495 you can take advantage of ObjectVision Runtime (sold separately). Runtime allows you to develop and distribute ObjectVision Windows applications to an unlimited number of users. All without extra royalties!

dOFFER!

Now, for a limited time* you can buy ObjectVision for ONLY \$99* (a tremendous savings off the \$495 list). And it comes with our standard 60-day, money-back guarantee. You risk nothing. **See your dealer** or call **1-800-331-0877** today.

B O R L A N D
Software Craftsmanship

CODE: MV45

*Offer good until September 30, 1991. Pricing is in U.S. dollars. Dealer prices may vary. Offer good in U.S. and Canada only. Copyright © 1991 Borland, 1800 Green Hills Road, P.O. Box 660001, Scotts Valley, CA 95067. BI 1411

CIRCLE 295 ON READER SERVICE CARD

BRIEFS

CONTINUED FROM PAGE 62

compression, and a disk sector editor with text search, verification of disk sectors, and disk mapping. A network version costs \$495. 415-454-7101.

XTree Co.'s \$69 *XTree Easy* is a low-end version of *XTree*, its DOS shell/menuing system. The program eases access to disk format routines and has a built-in ASCII file editor. It performs all DOS functions from pull-down menus. 805-541-8053.



PRINTER SHARING

Excellink has begun shipment of the JetCard/Si (\$795 to \$1,795), a printer-sharing card that plugs into the modular I/O slot in Hewlett-Packard's LaserJet III Si. The board provides up to 15 users with 1MB to 4MB of memory for concurrent print buffering. 408-946-3646.

ASP Computer Products is now shipping a 12-port version of its SimPLAN ServerJet printer-sharing device for HP LaserJets (\$895). The device offers both serial and parallel connections, fits into the expansion slot of any LaserJet, and supports 256K to 4MB of buffered memory. 408-746-2965.



LAPTOP ACCESSORIES

Hong Technologies has introduced two \$395 external parallel port adapters that allow laptops to connect to a network without losing local printer access. The HT-PP108ETP supports 10BaseT networks, while the HT-PP108ECX supports coaxial networks. 415-964-0100.

MegaHertz Corp. has released a series of external Ethernet (\$599) and Token-Ring (\$999) adapters for laptops. Both notebook connectivity adapters utilize the 100-pin bus expansion connector found on Toshiba and Compaq notebooks. 801-272-6000.

Xircom is shipping a pocket 3270 adapter for portables and notebooks (\$795). The product provides micro-to-mainframe links through the parallel port and attaches to a 3274/3174 or equivalent via a coaxial connection. The pocket adapter comes bundled with Microcom's *Relay Gold* or *Relay Gold for Windows*. 818-878-7600.

33-MHz 386 Portable Weighs 14.8 Pounds

NEW Micronics Computers' Mport 333 is a 33-MHz 386DX computer weighing 14.8 pounds. The \$4,995 system comes standard with 4MB of 32-bit RAM (expandable to 8MB) and 32K cache memory, a 40MB hard disk, a 1.44MB floppy disk drive, a half-sized expansion slot, and a paper-white VGA LCD with 32 shades of gray. Micronics also bundles each system with DOS 4.01, *Microsoft Windows* 3.0, and a three-button mouse. The unit measures 4 by 12.25 by 16 inches and requires AC power.

Micronics offers a 120MB hard disk version of the Mport 333 for \$5,495. A 25-MHz version, the Mport 325, is also available; it sells for \$4,195.



The Mport 333 is no notebook. At 14.8 pounds, this powerful "luggable" PC offers minimal portability.

List Price: Mport 333, with 40MB hard disk, \$4,995; with 120MB hard disk, \$5,495. Micronics Computers Inc., 232 E. Warren Ave., Fremont, CA 94539; 415-651-2300.

CIRCLE 441 ON READER SERVICE CARD

AST Bravo 286/16 Can Be Upgraded to 386SX

NEW AST Research's Bravo 286/16 is a 16-MHz 286 that can be converted to a unit with a faster 386 processor, thanks to its upgradable architecture.

The \$1,545 AST Bravo 286/16 Model 43 comes with 1MB of RAM (expandable to 16MB), a 40MB hard disk, a 3.5-inch floppy disk drive, one free internal 3.5-inch drive bay, two external 5.25-inch drive bays, five full-length 16-bit expansion slots, a Super VGA adapter with 800-by-600 resolution with 16 colors, two parallel and two serial ports, a mouse port, and a keyboard port.

The 386SX/20 version of the Bravo offers 2MB of RAM in its standard configuration (expandable to 16MB). It sells for \$2,395.

List Price: AST Bravo 286/16 Model 43, \$1,545; AST Bravo 386SX/20 Model 43, \$2,395. AST Research Inc., 16215 Alton Pkwy., P.O. Box 19658, Irvine, CA 92713-9658; 800-876-4278, 714-727-9292.

CIRCLE 442 ON READER SERVICE CARD

Hand Scanner Built to Complement Intel's SatisFAXtion board

NEW Intel's Personal Computer Enhancement Division has released a hand-held scanner developed jointly with Logitech as an add-in to Intel's SatisFAXtion PC-FAX board. The 256-shade gray-scale scanner offers resolutions between 100 and 400 dpi, scans half-pages (4.1 by 20 inches), and runs off a built-in proprietary port on the board, eliminating the need for a separate scanner-controller card.

The scanner is bundled with *Ansel*, a Windows-based image-editing program that includes utilities for adjusting brightness, contrast, or image size. The SatisFAXtion board includes 9,600-bps fax and 2,400-bps MNP 5 data modems.

List Price: SatisFAXtion hand scanner, \$399; SatisFAXtion board, \$499. **Requires:** SatisFAXtion board, *Microsoft Windows* 3.0. Intel PCED, CO3-7, 5200 NE Elam Young Pkwy., Hillsboro, OR 97124-6497; 800-538-3373, 503-538-3373.

CIRCLE 443 ON READER SERVICE CARD

IntelligenceWare Ships Error-Detection Tool for dBASE and Lotus

NEW *DBS:Database Supervisor*, from IntelligenceWare, detects errors and anomalous data items in large databases, and enforces integrity constraints.

The \$490 tool automatically finds unusual entries and patterns in a variety of database formats including *dBASE*, *Lotus 1-2-3*, and ASCII files.

In addition, you can use *DBS:Database Supervisor* in unison with *IXL: The Discovery Machine*, which discovers rules, patterns, and correlations in your data, and *DVT:Data Visualization Tool*, which extracts information and displays database files in two- and three-dimensional graphics.

IntelligenceWare also offers a VAX/VMS version of *DBS:Database Supervisor* for \$7,500, an XDB version for \$990, and a Teradata database version for \$10,000 and up. Unix and DB2 versions will soon be available. ■

List Price: *DBS:Database Supervisor*, \$490. **Requires:** 640K RAM, DOS 3.0 or later. IntelligenceWare Inc., 5933 W. Century Blvd., Los Angeles, CA 90045; 213-216-6177.

CIRCLE 701 ON READER SERVICE CARD

When there's only one LaserJet® to go around...

It's a lesson you learned long ago — how to share with others. But unfortunately, no one ever informed you of the ways to share a LaserJet® printer.

...you learn how to share.

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This printer sharing device for the HP LaserJet Series II, IID, III, and IIID is perfect for environments with several PCs and/or Macintoshes. Why spend money on multiple LaserJet or PostScript® printers when you can share one LaserJet with up to five PC and Macintosh users?

Pacific Connect slips conveniently into the optional I/O slot on a LaserJet printer. So it's easy to install and easy to use. No other LaserJet printer sharing device comes complete with all the cables, adapters and Macintosh support needed. Of course, PostScript operation requires Pacific Data Products' award-winning PostScript language emulation cartridge, **PacificPage™** and the additional printer memory needed for printing PostScript files.

As if each user were printing to his own printer, **Pacific Connect** eliminates the need for mechanical switch boxes or networking software. And print jobs are placed in the user-upgradeable buffer memory of 256k or 1.25 MB, and printed in the order that they are received.

For product information contact Pacific Data Products at 9125 Rehco Road, San Diego, CA 92121, USA, (619) 597-4602 FAX (619) 552-0889

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BRIEFS



CONNECTIVITY

Datastorm Technologies is offering a free upgrade to

ProComm Plus 2.0, which the company says fixes bugs in terminal emulation found in that release. Version 2.01 also offers improved support for the 16550 UART high-performance serial controller chip. 314-443-3282.

Attachmate Corp. has updated *Extra! for Windows* (\$425), its PC-to-mainframe connectivity package. Version 3.2 adds new functions, including editable record/playback macros, "host-aware" DDE use, Visual Basic support, and HLLAPI pass-through. 800-426-6238.

Tallgrass Technologies has added network functions to *Filesecure*, its tape-backup software. The new utility, called *OverNet* (\$295 for unlimited use), allows network administrators to backup every disk on every network node. *Overnet* is bundled with Tallgrass' SCSI drives. 800-736-6002, 913-492-6002.



FINANCIAL SOFTWARE

On the Go Software has added a general ledger utility

to *Expense It!* (\$89.99) that is file-compatible with *DacEasy*, *One-Write Plus*, *Platinum Series*, and *Quicken*. Version 2.0 of the expense report manager has also added a file link to the Sharp Wizard and ZQ-5000/5200 palmtop computers. 213-578-9595.

The Financial Software Co. has added four new "bond yield to maturity" formats, as well as an IRA calculator to *Finance 10* (\$69.95), its collection of ten personal finance programs. The package includes calculators for bond yield, depreciation, lease-versus-purchase analysis, and individual retirement accounts, among others. 800-332-2983, 213-931-1527.

M.L.A. Software now offers *Collections Plus* (\$495), an automated accounts receivable collection system. It includes a collection calendar showing outstanding funds at 30-day intervals, a letter generation schedule, and a text editor. The program acts as an add-in to the *Peachtree*, *BusinessWorks*, and *Great Plains* accounting packages, and can mail-merge with *WordPerfect*. 800-888-8753, 801-565-8753.

Faster SuperPrint Offers More Drivers and Windows Fonts

IMPROVED **Zenographics** is claiming major speed gains in both printing and screen display for Version 2.0 of *SuperPrint*, its software-based *Microsoft Windows* LaserJet print-speed enhancer. Also added to this version are the complete set of Adobe PostScript-compatible typefaces and Bitstream's Charter, for a total of 36 new faces. Support for .BMP, Targa, and color and black-and-white TIFF graphics formats is now included. Version 2.0 also fixes a *Windows* bug which incorrectly displayed large fonts.

Between the last maintenance release (Version 1.1) and the current version, Zenographics released a series of special "SuperMetafile" page description files for high-end graphics devices. They do not drive devices directly, but allow remote support for film- and slide-creation devices such as the Matrix film recorder and the Canon color copier, and are now included with the product.

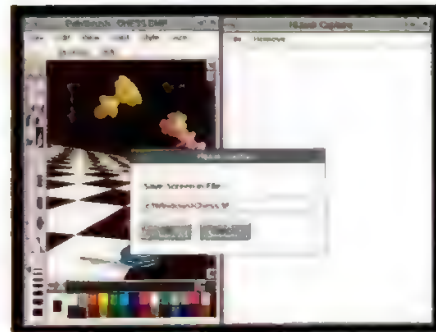
List Price: *SuperPrint*, Version 2.0, \$195; color thermal version, \$395; upgrades, \$75.

Requires: *Microsoft Windows 3.0* or later. Zenographics, 4 Executive Circle, #200, Irvine, CA 92714; 714-851-6352.

CIRCLE 444 ON READER SERVICE CARD

HiJaak Now Captures Super VGA Images

IMPROVED **Inset Systems** has released DOS/*Windows* versions of its screen-capture and graphics file-conversion utility, *HiJaak*, which now captures screens with 1,024-by-768 resolution and 256 simultaneous colors. The suite of graphics utilities also includes conversion utilities for 33 flavors of TIFF, two *Windows* Metafile formats, improved .DXF support, seven new fax formats, and both RGB (red, green, blue) and CMYK (cyan, magenta, yellow, black) color-separation models for Adobe PostScript files. Utilities for clipping rectangular portions of captured screens, remapping individual colors, and modulating text resolutions have been added to Version



HiJaak 2.02 converts among 35 graphics file formats, including 33 flavors of TIFF.

2.02. Expanded and extended memory support has been added for faster file conversion.

Super VGA card support encompasses cards from ATI Technology, Hercules Computer Technology, Micron Technology, Orchid Technology, Paradise Systems, STB Systems, and their respective clones.

List Price: *HiJaak*, Version 2.02, \$199; upgrade for registered users of Version 2.0, free; upgrade for previous versions, \$50.

Requires: DOS 3.0 or later. Inset Systems Inc., 71 Commerce Dr., Brookfield CT, 06804-3405; 800-828-8088, 203-740-2400.

CIRCLE 445 ON READER SERVICE CARD

Micro-to-Mainframe Link Uses DDE

IMPROVED **Microcom** has released the *Microsoft Windows 3.0* version of its terminal-emulation, English-language scripting, synchronous/asynchronous micro-to-mainframe connectivity package, *Relay Gold 5.0*. Offering connection through coaxial boards, LAN gateways, or modems, the *Windows* package is script-compatible with previous DOS versions. Bidirectional DDE links let *Relay Gold* perform background connections or pull data out of linked *Windows* applications.

Relay Gold for Windows adds TeleVideo Model 910, Adds 25, Hazeltine 1410, and Lear Seigler ADM-5/3A to its list of mimicked terminals. Other new features include an on-screen 3270 keyboard emulator, font scaling, and support of the *Windows* help engine.

List Price: *Relay Gold 5.0 for Windows*, \$399. **Requires:** *Windows 3.0*. Microcom Inc., 500 River Ridge Dr., Norwood, MA 02062-5028; 617-551-1000.

CIRCLE 446 ON READER SERVICE CARD

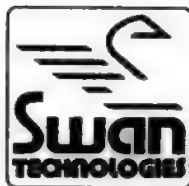
Accounting Package Switches DOS Tasks

IMPROVED **Manzanita Software Systems'** accounting software, *BusinessWorks*, has added a menu option to run other DOS-based applications from within the program. Extending the modular system's options, up to ten different tasks may be assigned as menu options. The kernel swaps out to free system memory.

Other enhancements to Version 7.11 include a ZIP code editor, expanded industry-specific charting, on-the-fly data entry, and improved support for third-party file formats. *BusinessWorks* consists of a kernel and six accounting modules.

List Price: *BusinessWorks*, Version 7.11, \$795 for kernel, \$295 per module. **Requires:** 512K RAM, DOS 2.1 or later. Manzanita Software Systems, 2130 Professional Dr., #230, Roseville, CA 95661; 800-447-5700, 916-781-3880.

CIRCLE 448 ON READER SERVICE CARD



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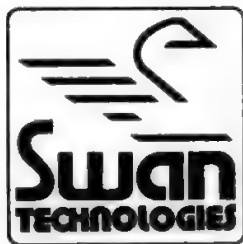
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- 200 Watt Power Supply
- Waitek 4167 Coprocessor Socket
- 5 Exposed 5.25" and 2 Internal 3.5" Device Bays
- Ports: 2 Serial, 1 Parallel
- 8) 16-bit Expansion Slots
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	Drive Options	Mono	14" Flat Mono	VGA Mono 1024 VGA
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w/200MB (16ms)IDE		\$3195	\$3245	\$3395
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Daniel Morgan
PC Magazine
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Quality computers are built with quality components. When you purchase a Swan computer, you can be confident that you are in fact getting only the highest-quality components. Swan selects from industry-leading manufacturers like Conner Peripherals, Teac, Quantum, Sony, Hewlett Packard and Intel. Bill Machrone, Editor-in-Chief of PC Magazine, said it best after a visit to our manufacturing facility,



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—PC Magazine, 9/11/90

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edited by
Matthew J. Ross

Read Only

Reviews of the Latest Books for the PC User

Wolverton on DOS 5.0: Eloquent Lessons On Just the Commands You Need

So far, DOS 5.0 has stirred up only a fraction of the hype that Windows 3.0 has, but it's sure to sell far more copies.

And while Microsoft has improved the DOS manual from an awkward three-ring binder to a better-written 670-page manual, Van Wolverton's *Running MS-DOS*, Fifth Edition, is a better guide.

Running MS-DOS is an eloquent waltz through the treacherous command line. You get a



lucid explanation of what DOS is and what DOS does, and even though the book could be used in a high school DOS 101 class, there are enough insights that even wizened DOS-ophiles won't get bored.

But Wolverton's book isn't everything to everybody. There's no more than a quick word or two about some of DOS's more technical commands, like DEBUG, ANSI.SYS, or QuickBASIC (which replaces GW-BASIC in DOS 5.0).

Wolverton takes a holistic approach to explaining DOS. He shows you how to get your work accomplished using DOS as a tool. In his lessons you'll create files and directories, customize your prompt, and write macros with the new DOSKEY utility. When he lists the commands in the appendix, Wolverton doesn't waste time explaining command line switches for programs he considers unimportant, like SHARE.

Running MS-DOS is not exclusively for DOS 5.0 users. It covers all the new DIR commands but also is backward-compatible. For example, in the "DOS Command Reference"

section, Wolverton catalogs the DOS version of every command—sort of a mini-history of "DOS: The Series."

Wolverton's earlier editions of *Running MS-DOS* have been at the top of the cognoscenti's reading list. With its clear explanations of our most important program, *Running MS-DOS*, Fifth Edition, will surely top the best-seller charts.—Christopher Barr

Running MS-DOS, Fifth Edition

by Van Wolverton, \$24.95, Microsoft Press, Redmond, WA 98052; 800-888-3303.

ISBN 1-55615-337-6.

CIRCLE 410 ON READER SERVICE CARD

Life at the Edges of the Information Age: Hackers or Computer Criminals?



Pengo is a troubled West German youth who roamed the U.S. computer networks, searching for software and secrets that he could sell to a KGB agent in East Berlin.

Kevin Mitnick is an overweight youth from L.A., whose manipulative skills gave him power over people, the phone system, and a vast array of networked computer systems.

Pengo, Kevin, and other real-life computer outlaws are engrossingly described in *Cyberpunk: Outlaws and Hackers on the Computer Frontier* by Katie Hafner and John Markoff, a husband-and-wife team of experienced computer journalists.

The first two-thirds of *Cyberpunk* details black-and-white episodes where socially maladroitness hackers pound on the gates of the citadel, only to find them unlocked. These tales are riveting—on a par with the best of Robert Ludlum's spy

thrillers—and also insightful, because Markoff and Hafner bring remarkable clarity to the technical aspects of hacking.

For many, especially parents of adolescents, the third part of the book is the most troubling. It is the story of Robert Morris, who let loose the famous Internet worm that crippled thousands of government and research computers. (A worm is akin to a computer virus, but it travels on its own, instead of using the virus's trick of infecting host software.)

Morris was exceptionally bright, came from a tightly knit family, went to the best schools, and with his father working first for Bell Labs and then the National Security Agency, was the ultimate insider. But he acted with inexplicable naïveté and irresponsibility when he let slip his devastating worm, and he ultimately paid a stiff price in the courts.

Cyberpunk is one of those occasional works of nonfiction that is more compelling than most

novels, but it is much more than just a good read. Hafner and Markoff have given us an important chronicle of what is happening on the edge of the information age, and it contains a timely message for all of us.—Kaare Christian

Cyberpunk: Outlaws and Hackers on the Computer Frontier

by Katie Hafner and John Markoff, \$22.95, Simon & Schuster, New York, NY 10020; 201-767-5937. ISBN: 0-671-68322-5.

CIRCLE 411 ON READER SERVICE CARD

A Manager's Guide to Data Protection And Security for Your Network

The hysteria and attention that computer viruses have received isn't completely warranted. So says Richard H. Baker in his second edition of *Computer Security Handbook*.

In this book, targeted for the nontechnical manager, Baker argues that people committing fraud are the biggest threat to your computer's security. According to the author, the average bank robbery nets about \$9,000 while the average computer crime pays \$650,000.

Baker presents sound advice on how to establish and maintain a secure network, but he offers no easy answers. As he says early in the book, "You cannot just throw technology at a security



problem. Security is a human problem."

Baker lays out the history of computer security dating back to the first recorded computer crime in 1958. The author concedes, "PCs make it easier to bypass the usual security and management controls that can be imposed over their more centrally controlled big brothers." But the democratization of the desktop can be controlled with security techniques and procedural controls that institute audit trails and data verification.

Analyzing your company's weak spots through risk assessment is essential, Baker counsels, and he recommends that all aspects of safety be examined,

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from fire extinguishers to uninterruptible power supplies. Then you can establish your baseline security controls.

Baker doesn't recommend products; he only diagrams techniques to secure your LAN.

If all you want to secure is one PC, you may find Baker's predilection for mainframes and minicomputers tiring. But for the

network manager responsible for a company's heart and soul, *Computer Security Handbook* dispenses down-to-earth advice: "Make a backup copy of everything."—Christopher Barr

Computer Security Handbook, Second Edition

by Richard H. Baker, \$24.95, TAB Professional and Reference Books, Blue Ridge Summit, PA 17294; 800-822-8138.

ISBN 0-8306-3592-0.

CIRCLE 412 ON READER SERVICE CARD

Technology 2001: Tomorrow's Ideas, Today's Technology

Predicting the future is no easy challenge. Perhaps this explains why the experts in *Technology 2001* tell us that the future is now—and why nothing in this book sounds terribly new.

Arthur C. Clarke contributes a brief forward, writing that HAL, the talking computer, will be late

to the party, not arriving till about 2100. It is just this type of idle speculation that nearly scuttles this collection of essays compiled by Derek Leebaert and subtitled "The Future of Computing and Communications."

The book's 12 chapters carry futuristic-sounding names like

"Anything, Anytime, Anywhere: The Future of Networking." Yet these are not future tales, they are stories of the here and now, written by experts who know computing and communications.

Denos Gazis of IBM contributes a wonderful, no-nonsense chapter called "Brief Time, Long March." He charts the course our recent technological past has taken, then assays our current condition for strengths and weaknesses. It is a fact-filled tour of the state of the industry.

Other chapters stand out for the same thoroughness, including an essay on networking by William Johnson of DEC and a look at document processing by Roger Levien of Xerox. The work is notable for its lack of stargazing and its dogged adherence to the facts. The writers know their topics and communicate their knowledge with skill.

Derek Leebaert, in his introduction "Later Than We Think...", is the one who raises the pointed questions: Who will control the flow of information? And how will the computer be integrated into our society?

Ultimately, Leebaert's book fails miserably at predicting the future, but it successfully surveys technology as it now stands. *Technology 2001* prepares us for the future by assessing our present condition with depth and accuracy, and by raising the questions that should stay poised on our lips as we hurtle forward.—Rick Ayre



Technology 2001: The Future of Computing and Communications

edited by Derek Leebaert, \$29.95, The MIT Press, Cambridge, MA 02142; 800-356-0343.

ISBN: 0-262-12150-6.

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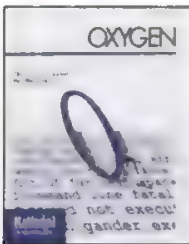
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Toolkits

Reviews of the Latest Tools for the PC Programmer

Oxygen Gives Your Microsoft C Compiler Room to Breathe

As C compilers and application programs have become more complex, software developers have found DOS's 640K memory ceiling more and more confining. Microsoft Windows developers who use Microsoft C



create new versions of the same files. Then when the "bound" CL.EXE or LINK.EXE is executed under DOS, the DOS Extender is loaded first. It then takes over to complete the loading of the actual compiler or linker and to provide a protected-mode environment for its execution. Most OS/2 function calls by the compiler or linker are trapped and converted to the corresponding

DOS calls, but memory-management function calls are handled entirely within the DOS Extender so that extended memory can be made available. In essence then, the DOS Extender provides an OS/2 compatibility box of sorts for the compiler and linker, allowing the symbol tables and buffers of each to grow far beyond the limits usually imposed by DOS, and significantly speeding up linking by reducing or eliminating the need for a disk swap file.

Oxygen is designed to be installed and then forgotten. The meager nine-page manual con-

tains only the sketchiest description of what *Oxygen* does, and the only sign that *Oxygen* is working at all is a one-line banner that appears just before the C compiler or Linker's name and copyright message. But if you need what *Oxygen* offers, you won't be offended by its Spartan nature.—Ray Duncan

Oxygen, Version 1.0

List Price: \$199. **Requires:** 384K extended memory; Microsoft C, Version 5.1 or 6.0. Rational Systems Inc., 220 N. Main St., Natick, MA 01760; 508-653-6006.

CIRCLE 686 ON READER SERVICE CARD

are particularly vulnerable to compiler "out of heap space" errors because of the elaborate C header files that must be included in a Windows application.

One possible solution to the memory problem is to use OS/2 as a development platform, but this route introduces difficulties because protected-mode Windows applications cannot be tested in the DOS compatibility box under current versions of OS/2. Another solution is to break up an application into smaller modules that can be compiled separately, but this answer only moves the memory problem to the linkage step, it doesn't eliminate the problem.

Rational Systems exploited its 16-bit DOS Extender technology and created a different solution to the C programmer's hunger for memory. The product is called *Oxygen*, presumably because it gives the C compiler "room to breathe" by allowing it to take advantage of extended memory on 80286-, 80386-, and 80486-based PCs. *Oxygen* relies on the fact that Microsoft C, Versions 5.1 and 6.0, contain both DOS and OS/2 executables for the compiler, linker, and associated tools.

During the installation of *Oxygen*, a specialized DOS Extender is "bound" to the OS/2 version of the C compiler's "driver" (CL.EXE) and to the segmented linker (LINK.EXE) to

VLIB Speeds Interface Design And Keeps Code Size Down

Users today expect colorful windows, easy-to-use menus, and forgiving data-entry systems. Admittedly, rolling your own user interface can easily take more time and code than writing the rest of your program. Yet commercially available user interface libraries are often too big, slow, expensive, or difficult to use. You can avoid these problems with *VLIB*.

At \$149, *VLIB* is less than half the price of most other commercially available user interface libraries. Its clean, logical design makes it easy to use, and its broad capabilities can satisfy most user interface requirements.

With *VLIB* you rarely have to specify coordinates for menus, forms, and pop-ups. It provides reasonable defaults for centering and spacing, although you can override them. Menu types include vertical, horizontal (Lotus style), rectangular, and pull-down. Two of the more unusual types of menus are horizontal buttons and multiselect menus, which al-



low the user to select multiple items from a list by toggling with the Spacebar.

The data entry system is powerful and complete. There is a built-in editor, automatic mouse support, and end-user-accessible

color change capability through a simple function call. Functions for the keyboard, the speaker, screen I/O, and file I/O are also included. A DOS critical-error handler displays messages neatly on the screen. Ctrl-Break and Ctrl-C handling is also provided.

A global error variable lets you check for internal memory allocation errors, and errors in the use of *VLIB* functions that occur during debugging. The next release of *VLIB* will check this variable and report the condition in a window if there's a problem.

VLIB adds very little code to your programs, keeping the size of your executables small and memory requirements to a minimum. One of the ways this is accomplished is by extensive use

of global variables. Unfortunately, this can also mean a loss of flexibility. For example, disabled menu items share the color attribute of normal text. To control the colors for disabled menu items separately, you have to go into the source, define a new global, and integrate it into the code. But the source code (provided with the package), is readable and easy to modify.

The *VLIB* manual is clear and well organized, although it could benefit from high-level descriptions of how groups of functions work together; the power and utility of *VLIB*'s features and functions are not always obvious. However, Pathfinder Associates does offer unlimited technical support, via phone or BBS, although you pay for the call.

VLIB is an easy-to-use library that meets most user interface requirements yet doesn't sacrifice code size or execution speed.—Sheryl Canter

VLIB, Version 3.15

List Price: \$149. **Requires:** Any current Microsoft or Borland C or C++ compiler. Pathfinder Associates, 291 Madrone Ave., Santa Clara, CA 95051; 408-984-2256.

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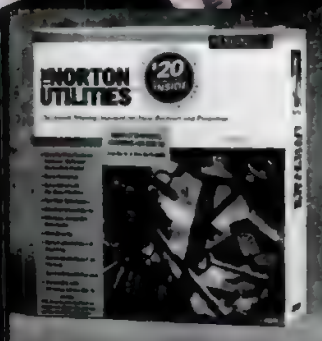


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CIRCLE 332 ON READER SERVICE CARD

Bill Machrone



Visual Basic Changes Everything

Visual Basic isn't perfect, but you'd never know it from the enthusiastic reception it's gotten in the marketplace.

I wish Microsoft had stuck with Visual Basic's code name. During development it was called Thunder. Microsoft should have marketed it that way. Then people who use Visual Basic wouldn't have to apologize for writing code in BASIC.

There's never been a real reason to apologize, of course. BASIC has always been a capable language, but with three strikes against it: It's too slow as an interpreter, too easy to understand, and lacks control structures.

In Visual Basic's case, three strikes don't make an out. Compilers long ago addressed BASIC's speed, but professional pride in understanding arcane programming languages will always be with us. Heck, if programs aren't a little obtuse, what's the fun of being a programmer? The structure part is a matter of discipline: Does it come from within you or is it imposed on you?

Well, Visual Basic puts the fun back in programming, no matter what your proficiency. In fact, it adds new kinds of fun to programming. You can do things with Visual Basic that have never been done before. You can also do them faster than the most accomplished professionals. The amount of work that's pre-done for you makes producing live code just as easy as prototyping. Visual Basic is easier than Lotus 1-2-3 macros, no harder than dBASE, and more productive than either one on the basis of lines of code per result.

Visual Basic also helps to take away one of Windows' biggest problems: Users don't stay in the environment. Back at Spring Comdex, I chaired a panel that examined the marketplace for Windows applications. I asked the more than 200 people in the audience how many used Windows. Virtually all did. I asked them how many ran just one Windows application. No more than 10 percent raised their hands. Two applications? Another 10 percent. Three or more applications? Every hand went up. Then, the clincher: How many stay in Win-

dows all day? No one raised a hand.

I started asking the audience at random why they left Windows. Many went to the DOS prompt to do simple file operations or to format disks, preferring that to using the dreaded File Manager. Others left Windows to use the myriad handy utilities they'd grown used to on the DOS side: file finders, directory managers, file de-duplicators, and all those tasty *PC Magazine* utilities.

Visual Basic makes those utilities a piece of cake under Windows. You can implement a drag-and-drop file mover in a couple of mouse clicks and a couple of lines of code. Really. Complete with scroll bars, dialog boxes, and directory listings. You can compile your code from a menu item within Visual Basic, and distribute your application to all your Windows-using friends. (Microsoft likes to add, "without a license fee or runtime charge," but Windows' \$99 price is a de facto license fee.)

EVERY USER A PROGRAMMER?

Now I don't expect every Windows user to become a programmer, far from it. For many, even the simplicity of Visual Basic will be too off-putting. Instead, Visual Basic applications



ILLUSTRATION: JOHN LABBE

will find themselves in three channels of distribution to serve the burgeoning ranks of Windows users: public domain, shareware, and commercial. The ratios are likely to be far different from most software, however.

For example, it's hard to charge money for a line or two of code, and a clever line or two is all it takes for many useful utilities. Thus, many quick-and-dirty VB applications will enter the public domain. Applications one level more complex are likely to find their way into



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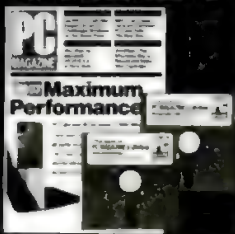
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Bill Machrone

the shareware channel, where authors are more willing to gamble on users' good will for their income. It's too early to tell what effect Visual Basic will have on the commercial *Windows* software market, but even if it proves to be lower in performance than C++ or Turbo Pascal for *Windows*, Visual Basic will get products to market significantly faster, because it's so easy to use.

BUT IS IT OBJECT-ORIENTED?

Visual Basic is a lot of things, but object-oriented isn't one of them. It's event-driven, which requires you to think in fresh terms about your programming. Indeed, without understanding the rudiments of event orientation, you can't make Visual Basic do anything. It's tempting to call the event windows and tools objects, but they're not. VB offers extensive control over properties, but it lacks the inheritance and polymorphism necessary in a truly object-oriented environment. It's also subject to the limitations of *Windows*, which is itself visually oriented, not object-oriented. The only way VB can communicate with other applications is through DDE, which isn't bad, but it's still a limitation and a complexity. Microsoft promises a future version, perhaps called Object Basic, that will interact freely with other applications, pushing their buttons and reading their data.

Meanwhile, Microsoft is far behind Borland and other companies in providing an object-oriented development environment. But Microsoft is significantly ahead of the pack in providing a slick interface and a painless way to develop *Windows* applications. Visual Basic is to BASIC what *Windows* is to DOS: a powerful, pretty face. It makes many things easier and more accessible, which some find threatening, others liberating.

The good news is that for many applications, VB's lack of object orientation is not a problem. While experts understand and agree that object orientation is the way to go for professional application development, not all programs need to be written that way. Sure, the pros have one more reason to sneer at BASIC. But just as their disdain hasn't mattered all these years, it continues not to matter for the quick and dirty application. Quick and dirty has never looked so clean. ■

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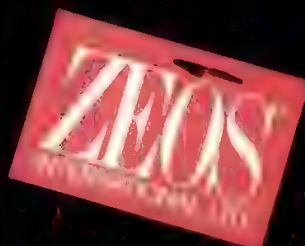
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- PC World, *"ZEOS' Notebook 386 earns a Best Buy thanks to a low price, fine support, and a solid set of features...it's the one to buy..."* Best Buy.
- John C. Dvorak, *"In this category I'm most impressed with the ZEOS Notebook...it has to be the number one contender."*
- PC LapTop, *"The notebook you've been waiting for."*
- Infoworld, *"This notebook is a steal."*
- PC Week, *"An outstanding value."*
- Mobile Office, *"The best price performer in its category."*
- Byte, *"The ZEOS Notebook...a clear winner...why settle for less?"*
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The Last Analogy

Understanding the developments that shaped American transportation may reveal the future of the computer industry.

Finding the perfect analogy that can help us predict the future of computing isn't easy. Here's my latest: a parallel between computers and the history of railroads.

While the history of radio perfectly parallels the nuttiness of the early days of personal computing (see "The Real Radio Days," March 14, 1989), the parallel falls apart in time. Too many manufacturers went out of business as the market matured. The automobile industry shows us how dealer networks can evolve, but something in that analogy is missing too. If we look at the PC movement not as a singular event but as part of a bigger trend, we discover that insights can be achieved by looking at the history of railroads.

Transportation. In the early days of American railroading, competing corporations were responsible for the distribution of goods. At some point, consolidation and government funding were necessary to manage a large-scale project. The end result was the completion of the transcontinental railroad.

In the early days of computing, individual scientists were working on computational concepts and models. But when the need arose for a large-scale machine for the military and space sciences, it required more than the work of individuals. A publicly funded project was necessary. The government did the same thing it did for the transcontinental railroad: It supported and directed the project, and the mainframe was born.

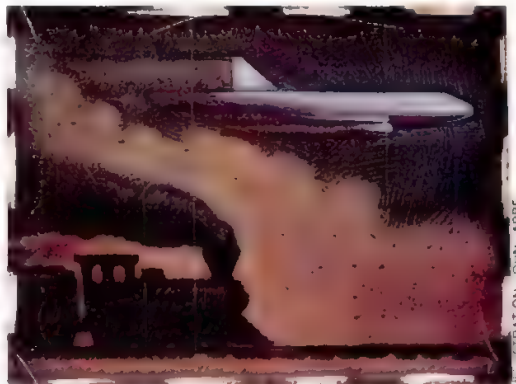
The railroad transportation scene soon evolved into huge railroading firms: the Southern Pacific, Santa Fe, and Burlington railroads that would provide rail service. One hundred years later, Sperry, Burroughs, Remington Rand, IBM, and other large companies were providing computers and service. But these big companies limited the versatility of their two respective industries. Railroads had specific hubs and stations where goods could be shipped and where people could be transported. With computers, there were centers where people had to go to get computing done. Arrogance permeated both scenes.

After World War II, President Eisenhower

began an interstate highway system that would parallel distributed processing in the computer world. Trucks supplanted trains as the preferred means of transporting goods. Buses and airplanes became a preferred means of transporting people. The interstate highways also made it easy for an individual to get in a car and drive coast to coast. This marked the death of the long-distance passenger train. In the same way, most of today's computer users rely on desktop PCs rather than mainframes. One wonders about the fate of the mainframe.

So we start to see parallels. The train and the mainframe. The truck and the minicomputer. The highway and networks. The car and the PC. The automobile is one piece of a bigger puzzle, just as the PC is a small part of a larger trend. Maybe ISDN will parallel the interstate highway system and be the key to the biggest changes as broadband ISDN becomes the medium for transporting large data packets from minicomputer to minicomputer.

The interstate highway system has turned many of our roads into cement tracks for rubber-wheeled trains in the form of semi-truck trailers. The latest movement is to legalize so-called *triples*, which are three huge



trailers hooked to one truck-tractor. The distinction between trucks and trains blurs, just as it does for minicomputers and mainframes. The traditional mainframe will, like railroads, be reserved for special big "freight" jobs where money savings are obvious. And like the personal automobile, a lot of people be will getting from here to there with their PC.

Now all I have to do is figure exactly how airplanes fit into this thesis.

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Inside Track

While rumors floated around that Apple Computer Corp. was going to enter the PC business, Apple was meeting with IBM over the possibility that **Apple will clone IBM's RS6000 RISC** (reduced instruction-set computing) workstation.

As readers of this column know, I've promoted the idea that an eventual change of computing platform is inevitable. With Compaq and Silicon Graphics teaming up with DEC, Microsoft, and MIPS to produce a **next-generation** personal workstation (that will be based on the MIPS RISC chip and perhaps running Microsoft's portable OS/2), you have to expect some kind of industry **reaction** to this consortium. Consider the alleged **bad blood** between Microsoft and IBM. Then consider the alleged bad blood (and the real-life lawsuits) between Microsoft and Apple. Add to that the perceived **threat** of a Compaq RISC machine aimed at the RS6000 and Sun workstations, and you have the makings of **strange alliances**. Hence Apple-IBM.

Microsoft has expertly played both sides against the middle since the first day it released MS-DOS. **Microsoft** looks more like an **arms dealer** as it sells software weapons to all comers, making a hefty profit as the combatants duke it out. But while some observers think that **business is war**, the warriors are beginning to realize that Microsoft is making big profits in too many dimensions. But nobody has been able to challenge Microsoft. The only company that makes a better mass-market operating system is Apple. But Apple has been loyal only to itself and not licensed its OS to anyone. That may change.

Apple's recent introduction of **System 7** has proven to most observers that when it comes to the GUI, Apple has **no peer**. *Microsoft Windows 3.0* is a good effort, but **suffers** from DOS limitations and **anomalies**. OS/2, considered an **outstanding** OS, has been taken over by IBM for all practical purposes, but Microsoft will continue to develop its version. Microsoft is keen on developing a **RISC version** using the talents of the developers of DEC's VMS OS headed by software guru David Cutler. Supposedly a slew of stock will change hands if certain goals are met.

Obviously, everyone is targeting a next-generation machine and **sides are being taken**. The three operating systems with potential are portable OS/2, Apple's System 7, and Unix. IBM, if allied with Apple, would be the only company with access to **all three**.

The Apple-IBM alliance is interesting because Apple has long been figured as a potential user of the Motorola 88000 for its next-generation machine. One West Coast reporter told me

that he believes **Motorola is involved** in the Apple-IBM talks, but not regarding the 88000. Apparently, the possibility exists that Motorola will **second-source** the IBM RS6000 RISC chip and the next-generation IBM RISC chip set. Apple cannot rely on a single source for its microprocessor, and it would be able to buy from either IBM or Motorola. As it now stands, Apple is **at Motorola's mercy** for the source of its 68030, used in its high-end machines.

Genuinely Interesting Software Dept.: Michael Newman, the poet-programmer, is offering his **unique and interesting** three-part system, *Michael Newman's Poetry Processor Package* (rhyming dictionary, poetry tutorial, and poetry processor) direct for just \$69.95. If you want to create a **rap tune**, teach your kids how to make a poem, or just add zip to those interoffice memos, you should have this system. It's as good as it gets. Call NewManWare at 212-439-4777 and order a copy.

Everyone Needs This Device Dept.: Do you have a lot of **unexplained computer crashes**? The problem may be improper AC wiring and **inadequate grounding**. According to one Canadian study, most computer problems can be traced to electrical grounding anomalies. DEC service personnel insist that 30 to 40 percent of their service calls regarding faulty computers can be traced to bad wiring. There are instances where people

found computers with "hot" cases. There's even a story about the network administrator who **was electrocuted** because he had one hand on a computer and touched a true ground.

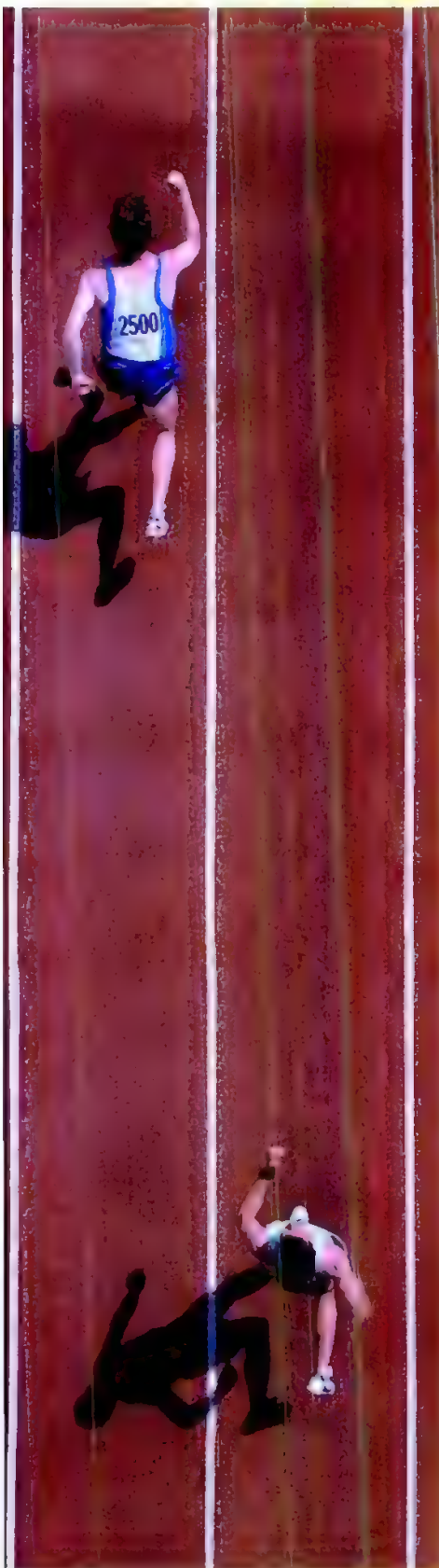
While **surges and jolts** make a difference, improper grounding plagues America: A surge protector does not protect you from bad wiring! There are three prongs in the socket and a **hundred things that can be wrong**. There are ground shorts, reversed polarities, open neutrals, ground and hot reversed, neutral and ground shorts, etc., etc. The only device I know of that checks all of these is the **patented Accutest II** wiring integrity tester. I recommend the complete \$198 system that plugs into each socket to be tested. Combined with a few probes, the Accutest II tests virtually every aspect of your wiring. It's **not a trivial device**! Whether you're a concerned homeowner or a corporate network administrator, **you need this kit**. It will guarantee a **lifetime** of confidence and also allow you to check the work of the electricians to whom you paid good money. Don't think twice about buying this system. It's made by Ecos Electronics Corp., 205 W. Harrison St., Oak Park, IL 60304; 708-383-2505. If you can't buy one of these devices, **borrow one**. ■

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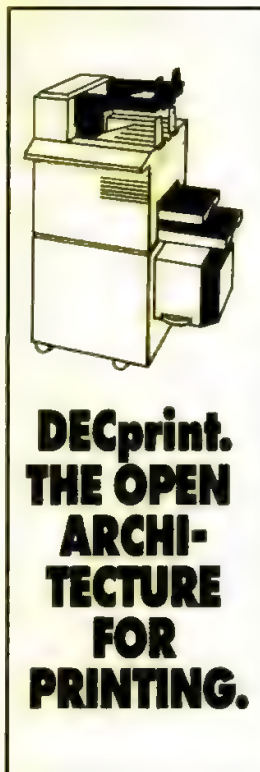
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Jim Seymour



Where Small Business Goes Wrong

In the name of economy, small businesses often waste a good piece of the investment they make in PCs.

Academic studies on the use of PCs in our society are a dime a dozen.

Most I've read are pretty thin on intellectual content and usefulness, but a few are solid, worthwhile pieces of work.

One of the better studies emerged recently from Ball State University. It looks at why small businesses often don't use PCs very effectively. I agree with its basic premise: Small businesses don't use PCs very well because they see them as single-function tools, akin to, say, dedicated word processors. But the issue of why small businesses so consistently suboptimize their use of PCs goes much deeper than that.

In my experience, there are five reasons small businesses get less out of their PC investment than they should. All have to do with limited and limiting visions of PCs and their role in a business. They include:

■ *Cutting the wrong corners.* Small businesses almost always buy PCs and software badly. They spend too little on hardware, too much on software.

They shave hardware costs by buying 8088 or 80286 PCs. They buy from the very lowest-cost suppliers, having been misled into believing PCs are interchangeable commodities. They buy too-small hard disks, older 10MB and 20MB models. They buy too little memory.

In software, though, they go in exactly the opposite direction, buying too *much* program for their needs.

It isn't a mistake for small businesses to buy horizontal-market standards such as *Lotus 1-2-3* or *WordPerfect*: A small business needs thoroughly vetted and reliable products, not oddball stuff. It's also easy to find new employees and temps who already know how to use these mainstream packages.

And even very expensive vertical packages can make sense—if they're aimed precisely at a business's main endeavor. Even the smallest architectural or engineering firm can justify

AutoCAD, despite its cost, since it's a highly evolved precision tool.

It is a mistake for a small business to invest in, say, *Ventura Desktop Publisher* for turning out an occasional newsletter, or *Advanced Revelation* for a customer database. A far less expensive, easier-to-use package would make a lot more sense.

Yet small businesses usually spend too much on the software side.

■ *Too little connectivity.* Because networks look big and scary, too few small businesses invest in connecting their PC users. Yet the rewards of connectivity to a small business are at least as great as for large businesses.

A simple network, such as *LANtastic*, can repay its cost in weeks. A small business is better off hiring someone to install even these simple networks, rather than letting a key employee become immersed in networkology—but that one-time cost is modest for a simple network.

■ *Zero investment in training.* Small businesses are worse than larger firms in getting training for employees using PCs. The myth is that because a small business is a looser, more relaxed place than a big office, Betty and Phil



ILLUSTRATION: JOHN LABBE

can figure out how to use this stuff when things are slow. But small businesses are rarely such calm places: The "Frenzy Quotient" is often a lot higher in the small office than in the large.

And even if workers in that insurance agency or dentist's office do have a lot of spare time on their hands, it's still a lousy idea to expect them to master PCs on their own. The payback for a day's training on each of the software packages used in the business is almost immediate.

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Jim Seymour

A trained employee doesn't waste time wondering if something's possible that isn't; doesn't spend hours poring over the manuals; doesn't spend still more hours on the phone with a software vendor's support people. And it doesn't matter whether that's an 800 call to WordPerfect Corp., or a dollar-a-minute call elsewhere: the cost of taking that employee out of the game for an hour, or a day, is the real cost to the business.

■ *No career-path contribution.* Large companies make certain employees know that their efforts to develop PC expertise, or at least some PC facility, will be an issue in their performance reviews, and an important contribution to their long-term career path with the company. But few small businesses show their workers that developing PC smarts will contribute to their careers with that firm.

In fact, the situation is usually just the opposite. A small-business employee who thought she was doing pretty well, chugging along and impressing the boss, suddenly gets a PC dumped on her desk. As she grows frustrated, left alone to flounder through the manuals, trying to figure out how to make this damned thing do what the salesman told her boss it *could* do, she feels herself slipping lower and lower in her boss's esteem.

A cynic might note that not many small businesses pay much attention to employees' worries about their career paths anyway; true, unfortunate... but irrelevant.

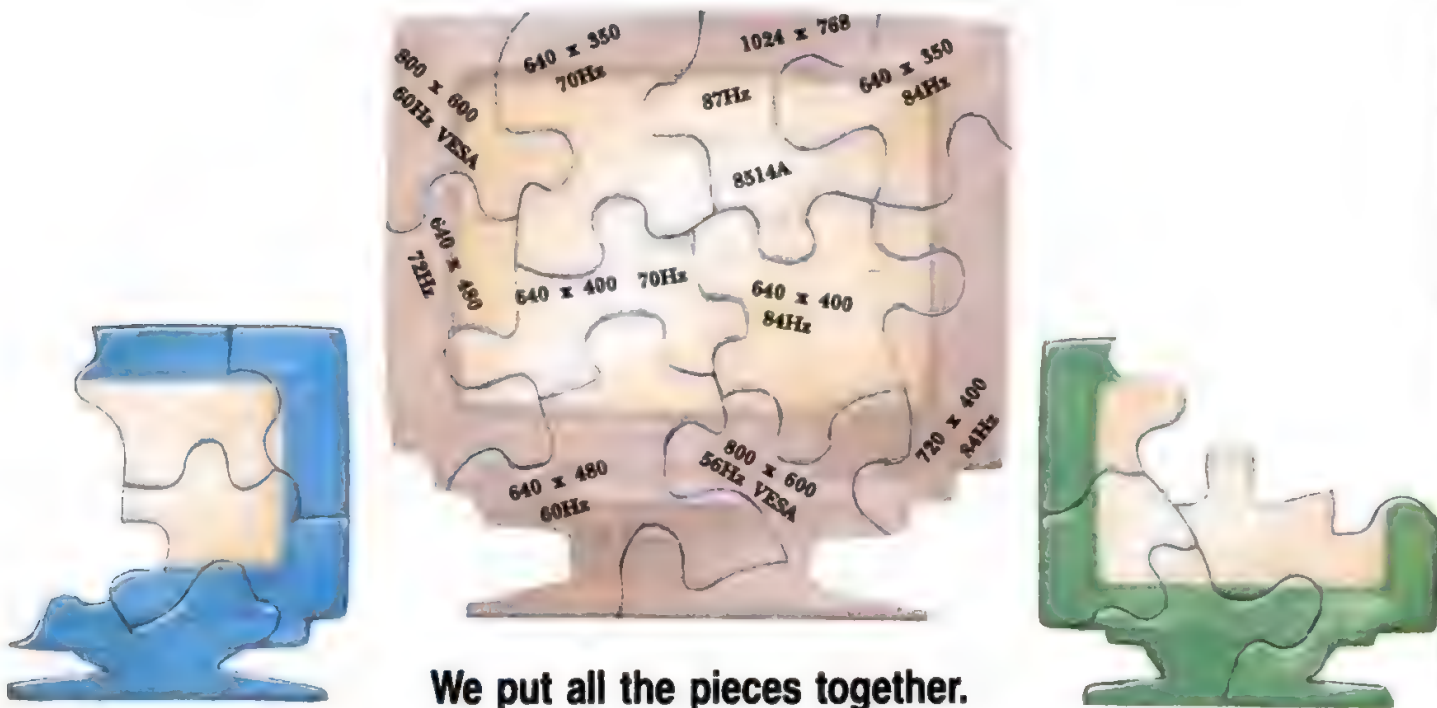
■ *Single-use PCs.* Finally, the point made by the Ball State study is exactly right: Small businesses generally buy a PC to do just one thing—keep the books, for example—and utterly ignore all the other ways it could be used to make the business more profitable.

For businesses that usually milk the last ounce out of every nickel—remember the wonderful line about the meat-packer, Swift & Co., which "sold everything but the squeal"—this one's a puzzler.

THE SOLUTION

You'd like a checklist of remedies as neat as this checklist of problems? But you have it: All of these failures are easy to correct...once you realize what you're doing. The answers lie in opening up small business's view of PCs—and in, finally, taking them seriously. ■

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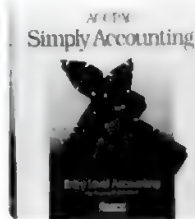
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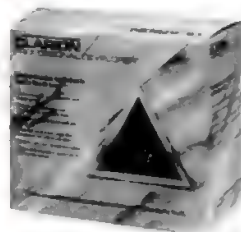
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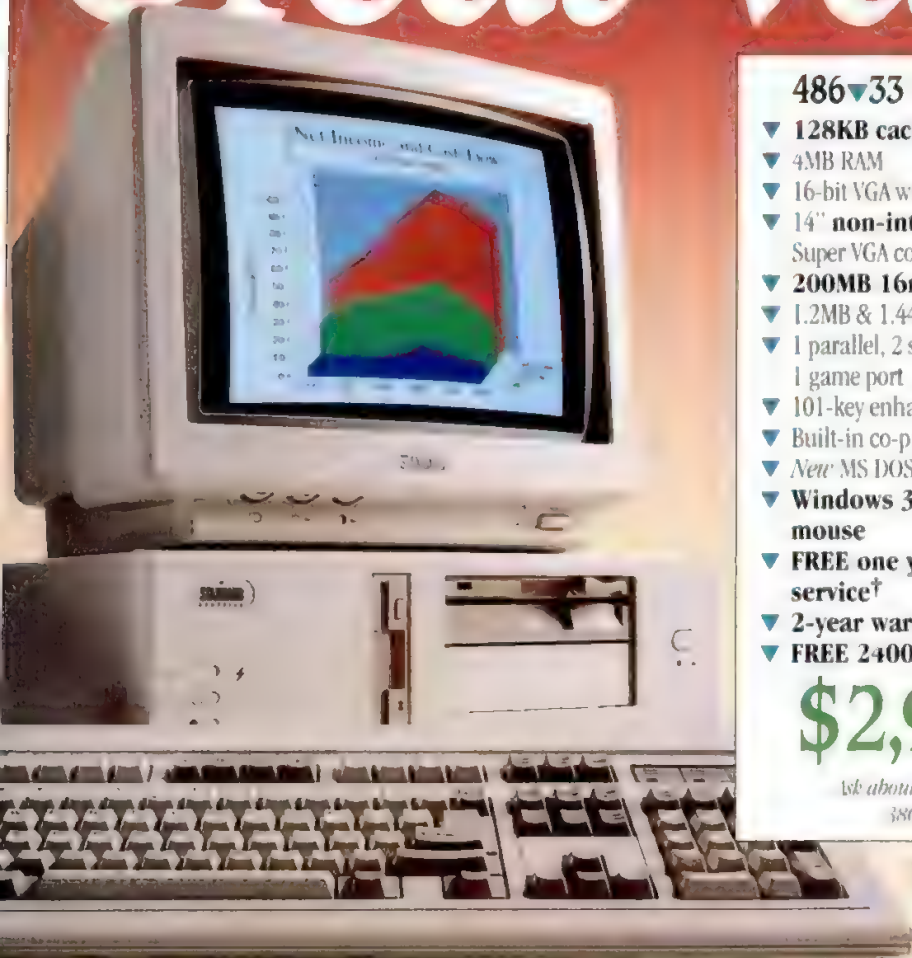
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Don't Believe The Hype

If you think that application availability is the key to success for a new platform, think again.

It's common knowledge: Application software is what sells hardware and software platforms. The first priority for vendors who introduce new hardware architectures or new operating systems should be to get software developers to write applications for the new platform. Right? Wrong!

Obviously, application software is necessary for the success of new hardware or software platforms. Nobody is going to buy new hardware systems or new operating systems if there is no software for them. Nevertheless, it's the fundamental capabilities of a new platform—not applications—that determine its success or failure.

If the platform has "the right stuff" it will succeed even if applications vendors are initially slow to develop for it. If it hasn't got what it takes, it makes no difference how much application software is available.

So what exactly is "the right stuff"? First, a platform must do something important and useful

and it must do so significantly better or cheaper than existing solutions. Or the new system must do something that earlier platforms can't do at all. Second, there must be an upward-compatible software migration path.

OS/2's problem was not lack of application software. Its problem was OS/2 itself. Early versions of OS/2 didn't even do what DOS could already do: print to a wide variety of printers or run existing DOS applications.

Until *Windows* 3.0 was released last year, *Windows* had similar problems. *Windows* acceptance was not driven by *Windows* applications, and even now, sales of *Windows* applications lag behind sales of *Windows* 3.0. The key to *Windows* 3.0's success was its ability not only to run DOS applications but also to run them better than DOS itself. If IBM makes good on its promises to provide "a better DOS than DOS" and "a better *Windows* than *Windows*" with OS/2 2.0, chances are good that OS/2 will take off just the way that *Windows* 3.0 did.

Right now, vendors are trying to promote Unix on general office desktops and also on the MIPS R4000-based Advanced Computer

Environment (ACE) initiative backed by (among others) Compaq, DEC, and Microsoft. For either of these efforts to succeed, users must accept new software platforms on a big scale.

Unix obviously has problems with respect to our criteria for success. It is by no means clear how Unix is "better" than existing alternatives for general-purpose, single-user desktop office systems. Unix also lacks a smooth migration path for current DOS systems.

Unix's advantages are primarily the result of its association with faster workstations built around RISC-influenced processors like the Sun SPARC architecture.

ACE is primarily an attempt to find better absolute performance and a better price/performance ratio from the MIPS microprocessor. It remains to be seen whether it will provide a better platform than Intel architecture systems offer. Even if the ACE initiative does come up with a better mousetrap on the hardware side, software continuity remains a problem.

Microsoft is banking on OS/2 3.0's Win 32 API. But unless Microsoft's "New Technology" OS/2 gets done a lot sooner than seems



ILLUSTRATION: JOHN LABBE

possible, it remains doubtful that *Windows* will be enough to make Win 32 a viable migration gateway.

The bottom line is that as time goes on, OS/2 2.0's "better DOS than DOS" and "better *Windows* than *Windows*" looks better and better. If I were a bettor, I'd still put my money on OS/2 2.0 with Presentation Manager as the most likely successor to replace DOS on most office desktops. ■

A detailed black and white illustration of an early telegraph system. A hand is shown pressing down on a telegraph key, which is connected by a wire to a sounder. The sounder consists of a coil of wire and a mechanical arm that can click or ring. In the background, a battery is visible, composed of several cylindrical cells. The entire setup is mounted on a wooden base.

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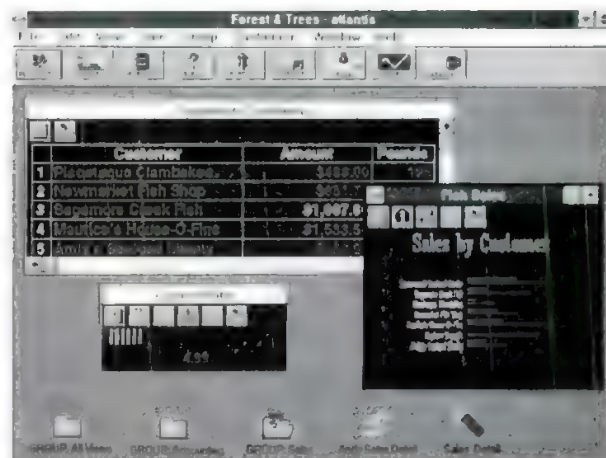
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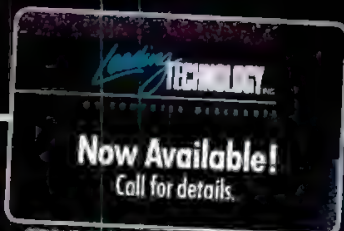
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Bringing Your Networks Together

BY FRANK J. DERFLER, JR., AND STEVE RIGNEY Few really successful organizations do business in just one place. The owner of a retail store dreams of establishing a franchised chain. Service organizations open outlets in other neighborhoods and cities. Corporations with offices in the east expand their reach to the opposite coast. The life cycle of business is the familiar pattern of nature: Grow and divide. Organizations that rely on networked PCs usually establish new LANs when they move to new locations. Soon they find they need



FROM LAN TO WAN

.....
Growing organizations
often need to
expand their networks
geographically.

This special issue
evaluates the options
available for LAN-to-LAN
connectivity so that
you can make the
right choice—at the right
price—for your wide-area
networking needs.

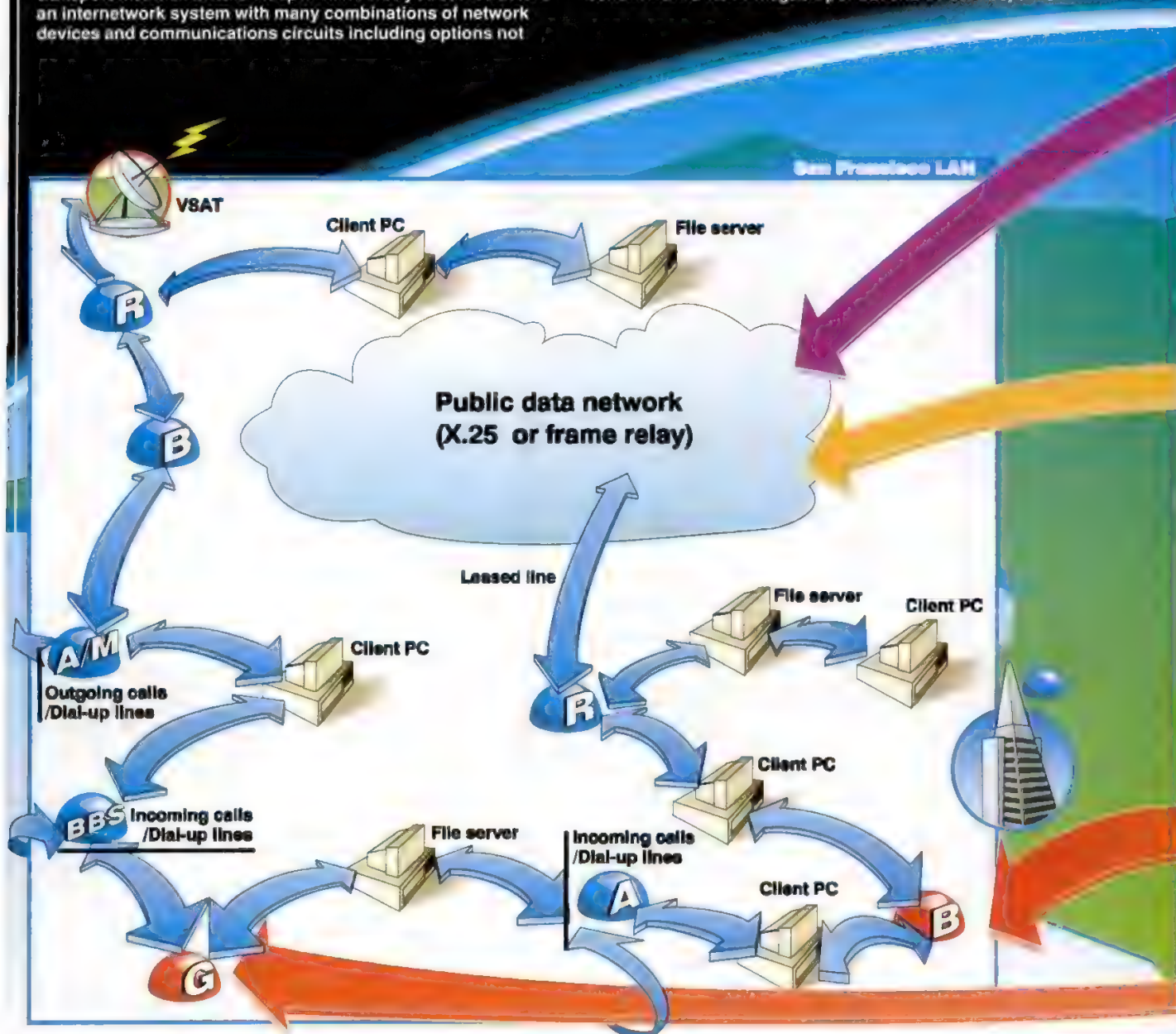
ACROSS THE MILES: BUILDING CONNECTIONS AMONG LAN SEGMENTS

This diagram illustrates a rather atypical LAN segment, endowed with practically every type of network interconnection device: bridges, routers, BBS software, access and modem servers, and e-mail gateways. The diagram also shows various communications circuits that can be used to carry data to other LAN segments: leased lines, VSATs, and public data networks, for example. In this issue, you'll find in-depth coverage of all these device and media options; how much they cost, when they are most appropriate, and how you can put them to work to make the most effective use of your LAN-to-LAN links.

In practice, you are not likely to employ all of the indicated network devices or media circuits on the same segment. The diagram simply points up the multitude of network devices and transport media available. Keep in mind that you can structure an internetwork system with many combinations of network devices and communications circuits including options not

shown here, such as FDDI, ISDN, and wideband microwave radio links. These last three are particularly appropriate for making connections within a metropolitan area; you will typically require a bridge at each end of the connection.

While this diagram shows routers connected through a public data network, note that a bridge, an access server, or even a BBS could also take advantage of PDN service. Typically, most users will rely on dial-up lines when internetwork communication is accomplished through access servers (including those with modem server capabilities for outgoing communications) or BBS software. For users who need to transfer large files or update remote databases, the leased line connecting two bridges on different LAN segments would benefit from a 1.544-megabit-per-second T1 service, which



CONNECTIVITY

FROM LAN TO WAN

could have subchannels broken out for an access server or even voice PBX connections.

If your primary means of internetwork communications is via an e-mail gateway, chances are that high-speed throughput is not the main concern; leased lines operating at a slower 19.2 kilobits per second or even public dial-up lines may be a more cost-effective investment. Your needs may simply call for the proprietary gateway module to link two LANs running the same e-mail software, or you may need to make use of MHS gateways to connect distant LANs running diverse e-mail packages.

Outfitting your business with VSATs (very small aperture terminals) makes sense when you have multiple locations that

are 500 miles or more from each other. VSATs can operate at speeds comparable to those of T1 links, but they make better back-up devices since they are not prey to the same problems that can strike land-based systems, such as natural disasters.





DECISION GUIDE: SELECTING LAN-TO-LAN NETWORK DEVICES

This decision guide walks you through the practical aspects of network interconnection devices such as bridges, routers, e-mail gateways, access servers, bulletin board system software, and wide area information transfer systems (WAITS). While you must choose between bridging and routing, the other devices are not mutually exclusive, and you might have two or more of them on the same network segment, possibly along with a bridge or router. For instance, not all your offices may be networked, but you may want to use e-mail gateways for those that are, while using BBS software to maintain communications with those that are not. Notice that you will choose a router when you don't have

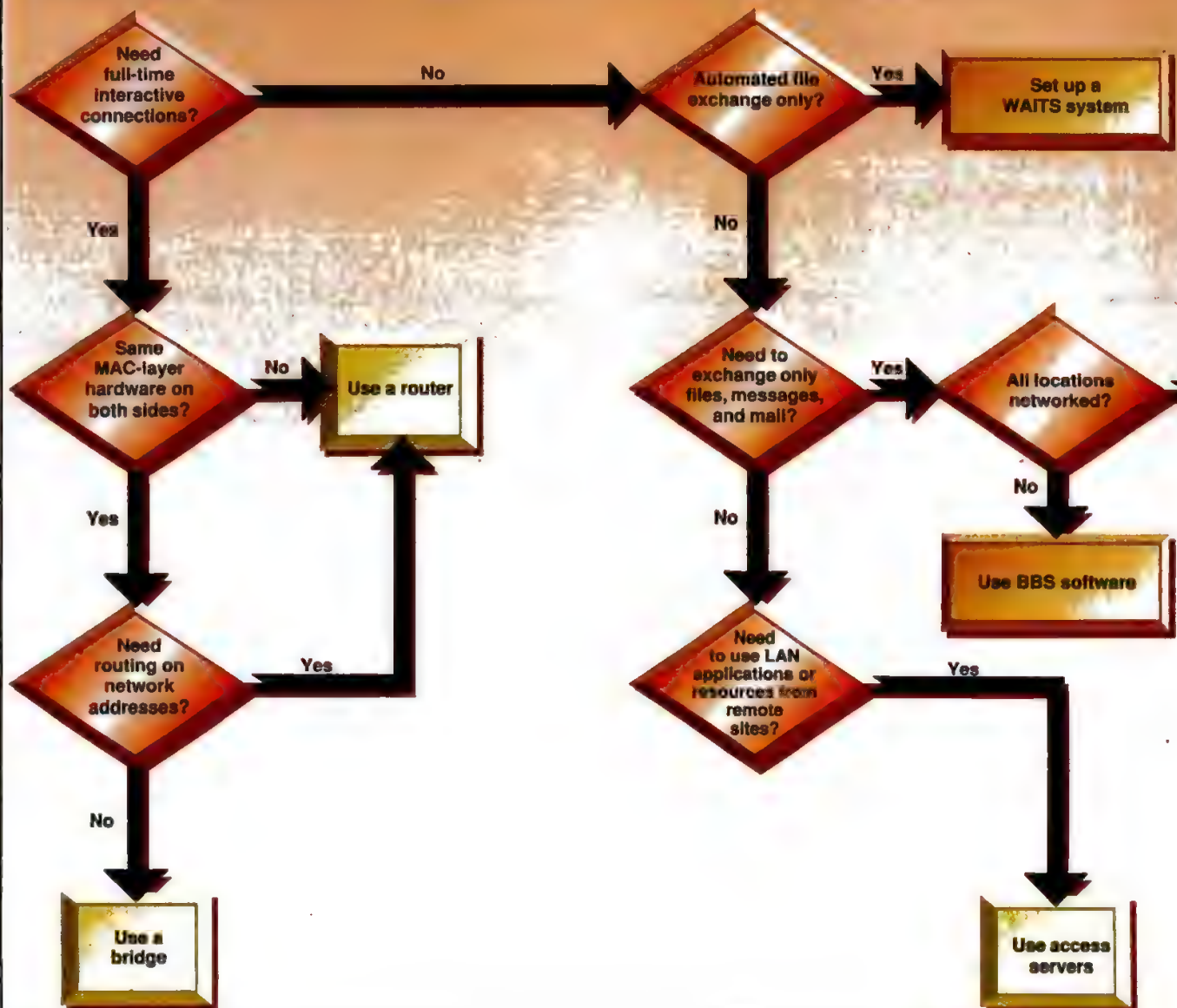
identical MAC-layer hardware on both sides of the connection—and also when you do, if you need routing on network addresses.

A WAITS system should work fine in organizations with a specialized need to transfer files across LAN segments automatically. If your organization relies on e-mail or groupware packages for communications in each location, you may be interested in LAN e-mail gateways, which let you connect with users on a distant LAN segment to share files and exchange messages. You'll want to use your e-mail package's MHS gateway module if you need to communicate with a LAN running a different e-mail program; if both LANs use the same package for e-mail, the proprietary gateway may be all you need—for now.

BBS programs are also good choices when you want to transfer messages as well as files. Like most e-mail and groupware packages, they provide private mail and public conference facilities.

They also have an advantage that packages limited to network use do not: They can facilitate communications with your employees who use standalone PCs out in the field and with any of your offices that may not be networked.

Sometimes an organization requires more than the ability to exchange messages and files; many companies want a way to provide their employees at remote sites with access to one location's network and all its resources. If you want your users to be able to run applications off your network, an



access server is the optimum choice.

Although most network devices are better suited to one kind of connection than to another, almost all of them can make use of any transport media. Choosing the transport media involves considering other factors such as distance, speed, the amount of data you need to move, and whether you want to buy or lease the connection. For more information on choosing the transport media, see "Decision Guide: Selecting LAN-to-LAN Transport Media" in the article "The Media Move the Message."

Yes

Use e-mail
gateways

to link the separate LANs in some way to support the corporate business.

Studies of traffic on internal corporate telephone systems show that the classic 80/20 rule applies: 80 percent of the calls are made within a local office and 20 percent go to distant corporate offices. The division of traffic on data networks is typically about the same. That is why organizations that conduct business in more than one place quickly realize the need to connect their networks to move significant volumes of data between locations. And it's not only networks that need to be connected; often companies are equally interested in bringing the power of their LANs to clients and non-networked employees out in the field, or even bridging the communications gap with smaller branch offices that might not be networked at all.

Since people need to move widely varying types and volumes of data, companies in the LAN and communications business offer products that make many levels of inter-LAN connectivity available. In this special issue, *PC Magazine* explains the techniques, problems, possibilities, and costs of LAN-to-LAN connectivity.

LAN-to-LAN connectivity and wide-area communications options range from relatively simple, informal arrangements using dial-up telephone lines and modems to technologically complex devices that examine every Ethernet packet or Token-Ring frame and make sophisticated decisions on its disposition. The cost of inter-LAN connections ranges from practically nothing to many thousands of dollars per month. Creating effective inter-LAN communications systems is a challenge that can influence the bottom-line effectiveness of an organization or business.

IMAGINE, IF YOU WILL . . .

When explaining LAN-to-LAN connection options, it helps to have a scenario to illustrate how and when these options can be most effectively employed. Imagine a sales organization with headquarters in New York and branch offices in Dallas and San Francisco. Each operating location has its own network of PCs. New York and Dallas use Novell's *NetWare* as their LAN operating system. The organization inherited a Microsoft *LAN Manager*

network in the San Francisco office as part of a corporate merger. All networks run over Ethernet.

In our scenario, the branch offices need to move data to and from the headquarters throughout the business day, and they also need to exchange some data with each other regularly.

Many LAN connection alternatives, including options reviewed here, do not move this data invisibly. People operating on one LAN segment must run specific programs, make connections, attach files, or give directions to make LAN-to-LAN communications happen. It takes training and experience to make these connections, and in most cases they don't happen in real time.

Many organizations need real-time invisible connections to enable people on one network to run the software they typically use and allow it to draw information from, send information into, print on, or make connections through other LANs. The devices that most efficiently make these full-time connections are called *repeaters*, *gateways*, *bridges*, and *routers*. We explain the significant—and insignificant—differences among these products in our story "Smart Links Between LAN Segments." The reviews in that section provide a detailed look at what is perhaps the heart of LAN-to-LAN connectivity, bridges and routers, and evaluate the impressive data-compression schemes that a number of them use.

Bridges and routers share the ability to examine packets or frames as they go by and then decide whether to pass them through the communications circuits linking the LANs. But they use different criteria to make their decisions and are more efficient with different combinations of LAN software and hardware.

In our scenario, the LAN segments' use of different network operating systems—*LAN Manager* in San Francisco and *NetWare* in New York and Dallas—is a significant factor in the choice between bridges and routers. Because *LAN Manager* and *NetWare* do not use the same transport-layer communications protocols, our multicity system needs a bridge to move complete Ethernet packets across the inter-LAN link. Modify the scenario so that all the LANs use the same software, either *LAN Manager* or *NetWare*, and a more discriminating router is probably the more appropriate choice.

Note that the only role of the bridge is

CONNECTIVITY FROM LAN TO WAN

to move the packets across the connection from LAN to LAN. Some processes or programs on either the *LAN Manager* or *NetWare* side must convert the request for file or print service contained in each packet into the proper format for the network operating system at the destination; one such program is Performance Technology's *POWERfusion Extras for DOS*, designed to link *NetWare* and SMB NetBIOS LANs. Neither a bridge nor a router makes LAN incompatibilities go away as e-mail gateways and BBSs do, and that difference is important.

EASY ACCESS

Perhaps the easiest way to exchange data among LANs is through remote control of a networked PC. The modem remote-control software market is well established, with many competitive products (see "The Next Best Thing to Being There," June 12, 1990). If we apply modem remote-control LAN-to-LAN links to our scenario, one PC on the Dallas network would use normal dial-up telephone lines to call a modem attached to a networked PC in New York. Once they were connected, the modem remote-

control software running in both PCs would provide an efficient way for someone in Dallas to make entries in a database, use electronic mail, or copy data files from the New York networks.

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LAN-to-LAN options
range from the fairly
simple to the
technologically complex.

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The software typically includes data compression and error control to get the most benefit from the telephone line. Modern V.32 modems can signal at 9.6 kilobits per second, and the compression protocols in the remote-control software can increase throughput to over 30 kilobits per second for certain kinds of files.

Remotely controlling a PC allows

someone calling from any location—even a nonnetworked one—to access the full power of the network. The caller can run programs, use printers, access a main-frame computer through a gateway, and otherwise act as a full member of the network. Remote-control programs include good security, but they cannot protect against poorly behaved software or human error. Modem remote-control programs do not care what network operating system or network adapter cards you use. These packages allow people to span the different LAN operating systems easily, as they would have to do with the *LAN Manager* and *NetWare* networks in our scenario.

While this type of remote-control connection is effective, at some level of activity it becomes uneconomical to keep individual networked PCs always ready to receive dial-in calls. When remote control of a networked PC becomes a frequent event, it is wise to establish a separate computer system to act as an access server that can handle many incoming calls simultaneously. In "Dialing Up the LAN," we examine seven access servers that use three different

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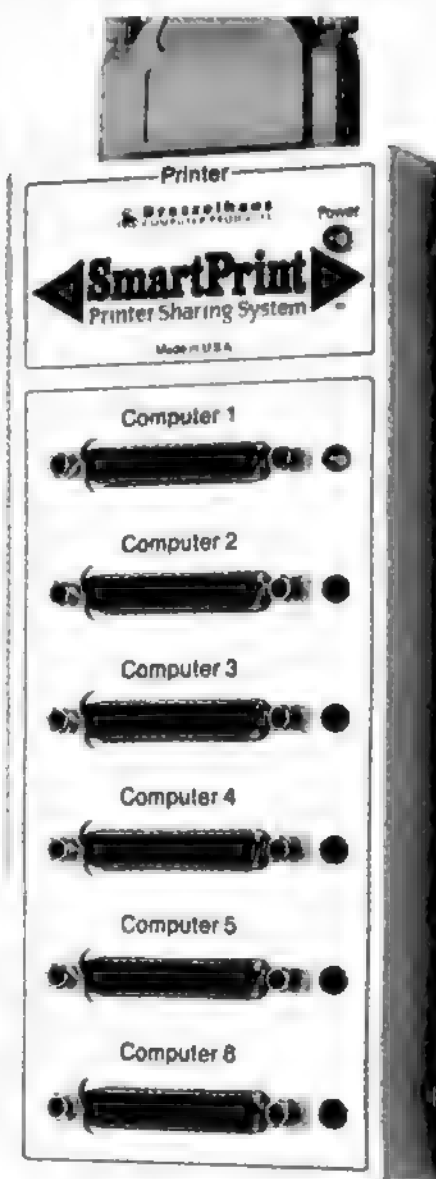
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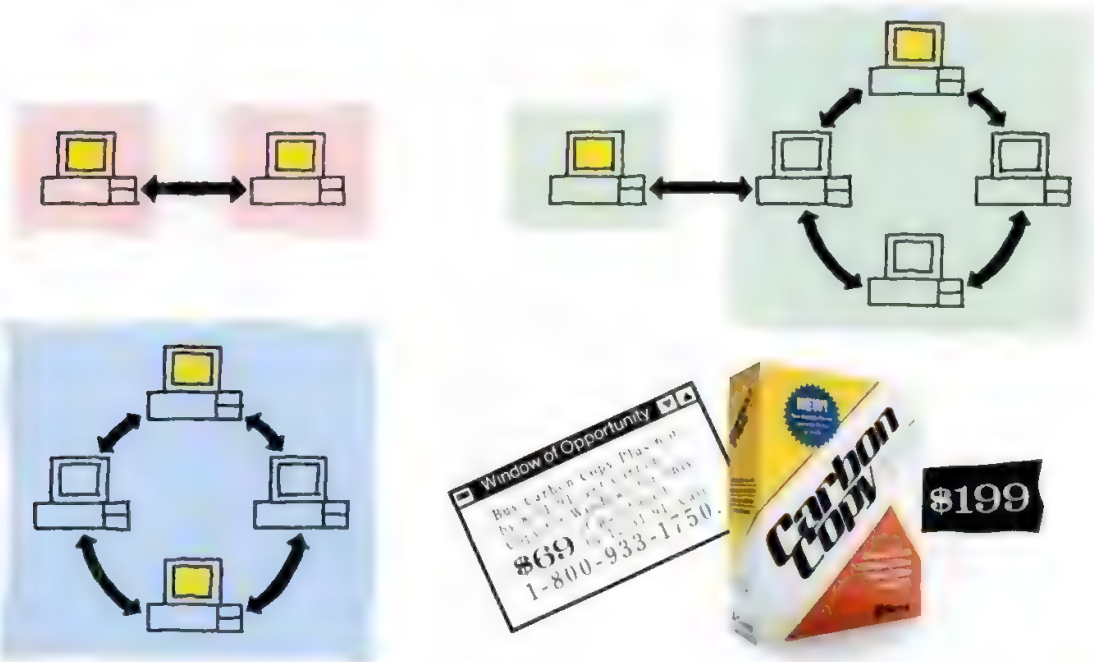
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CONNECTIVITY
FROM LAN TO WAN

architectures to get the job done. All make use of remote-control software to provide calling users with full access to the network resources to which they have been assigned rights.

Almost all the access servers in our review can also share their resources in a different way; they can provide a pool of modems for network users making outgoing calls. Although the price of V.32 9,600-bit-per-second modems is dropping, the modems typically cost between \$600 and \$1,000. Sharing these modems among as many people as possible makes economic sense. Access servers acting as a modem pool can share these devices, but you have to use some specific techniques to link communications programs running on networked PCs to the shared modems.

BBSs AS BUSINESS TOOLS

A similar way to gain entry to a LAN, although with different goals and a different lineage, is to use bulletin board systems, or BBSs. BBS software packages can be useful not only for connecting users on diverse LANs but also for promoting wide-area communications in

companies whose various offices are not completely networked (or not at all). In "Tools for Wide-Area Communications," we take a look at ten products that are well suited for business applications because they provide support for simultaneous incoming callers, as well as for technologies that allow remote BBSs to connect with each other, such as FidoNet and PCRelay. We also required that the software be able to run on a workstation attached to a LAN.

A menu of messages and functions greets callers when they dial into a BBS. They can easily read and post messages or upload and download files, but always under the tight functional control of the BBS software. All the products reviewed here can store data on a network file server. But a BBS insulates the network from callers; they cannot run programs that might crash the remote system or change important files on the server.

In our New York/Dallas/San Francisco scenario, PCs running BBS software on all the LAN segments would provide (among other things) an excel-

lent way for customers and suppliers to post orders, pick up orders, and interact with branches of the organization without gaining full access to the network. The simplified format of a BBS menu also makes it easy for members of the organization who are on the road to upload or download files, as well as to exchange mail and messages.

LINKING THROUGH E-MAIL

Once the use of LAN-based electronic mail reaches critical mass in an organization, people wonder how they ever did business without it. Although many people send e-mail messages when making a telephone call is not convenient, electronic mail can also take on a life of its own. Users often find they can coordinate large projects involving many people and resources more efficiently through electronic mail than any other way, including face-to-face meetings.

Mature electronic-mail systems are not limited to a single LAN segment. E-mail gateway programs running on networked PCs can automatically dial each other to exchange messages. They can operate on a regular schedule or make

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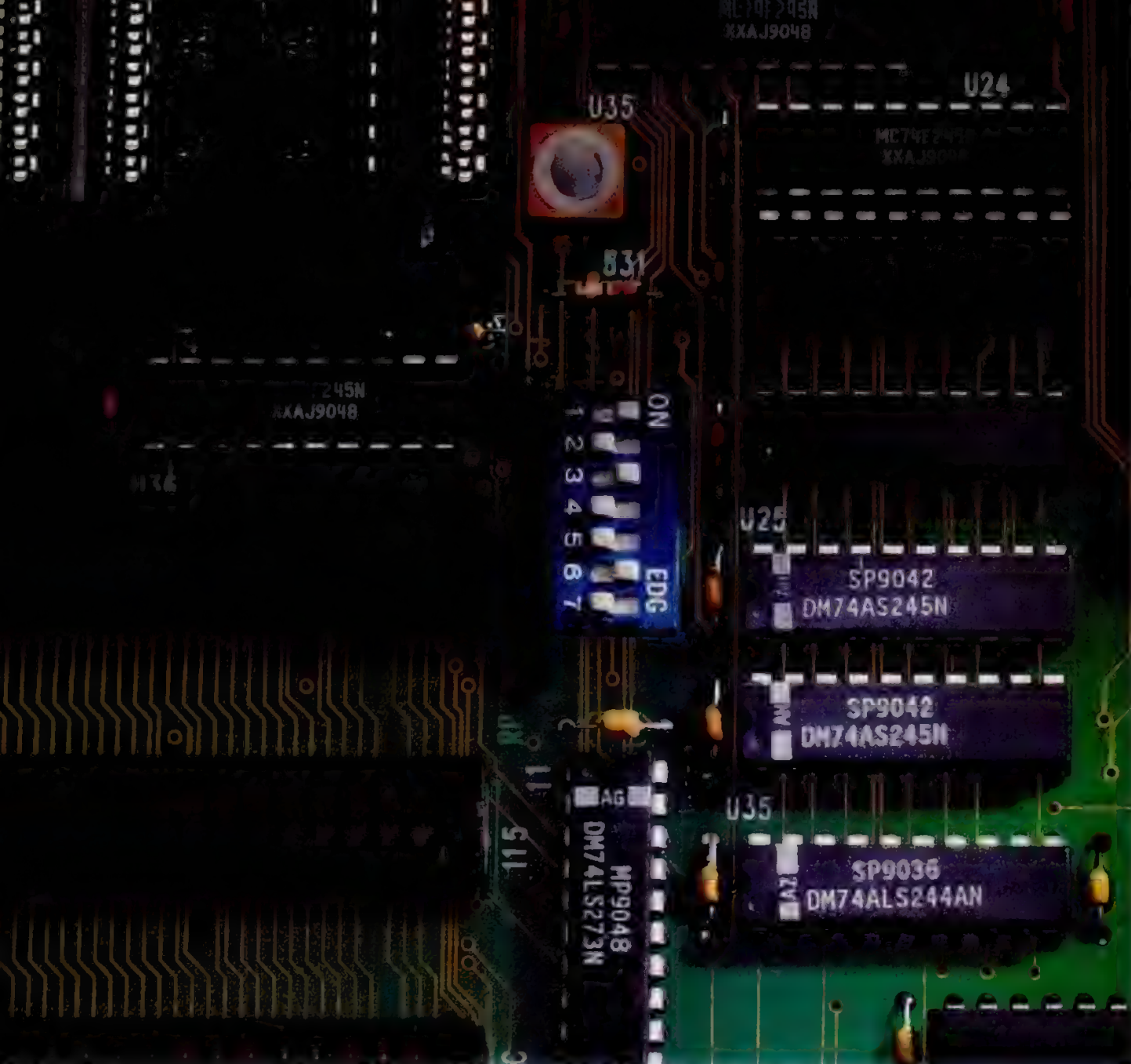
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calls only when the volume or priority of messages warrants the action.

In addition to proprietary e-mail gateways that provide links between identical electronic-mail systems, many LAN e-mail and groupware vendors offer modules that support Novell's Message Handling Service (MHS). The flexibility of modern e-mail systems allows each person on the network to use his favorite electronic-mail package while still communicating throughout the network. Products such as *Novell MHS* can translate between different electronic-mail programs running on a local LAN segment or on very different networks, including those based on mainframe computers. E-mail packages are not limited by differences in LAN operating systems or cabling schemes, although some packages offer specific management features under an operating system like *NetWare* that they do not provide under other network systems.

Because you can attach binary data files to electronic mail messages, e-mail offers an excellent way to conduct all of your LAN-to-LAN business. When the San Francisco office gets the closing sales figures at the end of the day, the branch sales manager can attach a spreadsheet or database file to a message addressed to the corporate sales manager in the New York office. If the San Francisco office does especially well with its sales, a carbon copy to the Dallas office might be in order. At an appropriate time, the e-mail gateway PC in San Francisco connects to the gateways in New York and Dallas and transfers the messages as files.

The process is not entirely automated, since the various managers must perform certain actions to attach the file and to save the attachment when it comes in, but these are simple steps and help them keep track of sales activity.

Our review of e-mail gateway products, "Gateways to the World," reviews five packages that provide support for both proprietary and MHS modules.

GETTING YOUR MESSAGE ACROSS

So far, we have described the connection devices that function on each LAN segment, moving files, messages, or packets on and off the LAN. When you need to link LANs, another important and potentially expensive layer of decisions awaits you, on the question of how to make the connection. Most people are familiar with

Designing an inter-LAN communications system is much like ordering from a menu in a Chinese restaurant.

modem communications over dial-up telephone lines. But a dialed call is not always the most economical link between LANs. The phone company bills you for dialed calls in terms of seconds of connection time and the distance between locations. And these costs add up quickly.

One option to consider is what are commonly called *leased lines*. Although modern telephone technology threatens to undermine the definition, most people think of leased lines as full-time connections between two points, billed at a flat monthly rate. The rate increases with the distance of the connection and with the data transmission speed you require. In our scenario, you would probably need three leased lines to connect the three locations in a triangular configuration from New York to Dallas, Dallas to San Francisco, and San Francisco to New York. In "The Media Move the Message," we describe your options for making the communications links between LANs, and also advise you on how to tackle jobs such as ordering leased lines. This section also provides details about alternatives to dial-up and leased lines, such as establishing your own satellite communications system or using the Integrated Services Digital Network (ISDN) technology that is emerging in cities around the world.

In our section devoted to public data networks, or PDNs (see "Reliable Relays"), we detail the services that are offered by packet-switched networks; their costs are usually unrelated to distance or connection time but they are extremely sensitive to how much traffic you send. Some of the major PDN vendors provided us with estimated costs for an expanded version of our connection sce-

nario. This article also describes new technologies such as frame relay and switched multimegabit data systems, which threaten to displace X.25 PDNs someday.

MAKING SELECTIONS

Designing an inter-LAN communications system is very much like ordering from a menu in a Chinese restaurant. You can combine choices from a list of network devices with choices from a list of media transport alternatives. Some of the selections will be expensive, and others can be very economical. More daunting than the composite price is the job of putting all the pieces together and making the system work for your company. The information in this special issue will help you make the right choices for your organization's needs.

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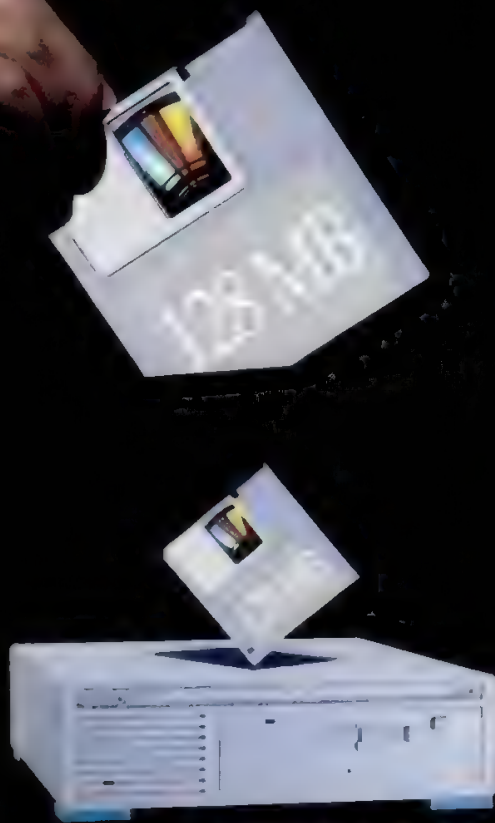
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**New LANTastic™, Windows™ interface,
3-cable adapters, Central Station™
multiport, ArtiScribe™ digital dictation
lead summer releases**

A flurry of new and upgraded Artisoft products were announced at Spring COMDEX, led by a faster, Microsoft Windows-compatible **LANTastic Network Operating System 4.0**. Just weeks later, LANTastic won its **third consecutive PC Magazine Editors' Choice Award**.

LANTastic 4.0 upgrades the peer-to-peer network standard for simplicity and effectiveness with its ability to work with Microsoft Windows in real, standard and enhanced modes, its most user-requested feature. An improved Lancache, further simplified installation on more varied systems, support for uninterruptible power supplies (UPS), and ability to unload the NOS from memory are some of the advanced utilities included in the new release.

Registered LANTastic endusers can upgrade to LANTastic 4.0 directly through Artisoft for \$50. The new version started shipping to Artisoft dealers in June. **LANTastic/Al™**, the adapter-independent version of the operating system, is also available for upgrade to 4.0 at \$99 per network.

The new **LANTastic™ for Windows™** utility provides the icons, pull-down menus and final link to make LANTastic NOS a true Windows application. It will be available this fall.

On the hardware side, Artisoft's new **AE-3™ Ethernet adapter** accepts twisted pair (10baseT) cables along with thin Ethernet (10base2) and thick Ethernet (10base5). The three connectors provide a simple network upgrade path of cable changes without

replacing adapters or even opening computer cases. It retains the other advanced features of the AE-2™ Adapter, including sensing and adapting to 8-bit or 16-bit slots.

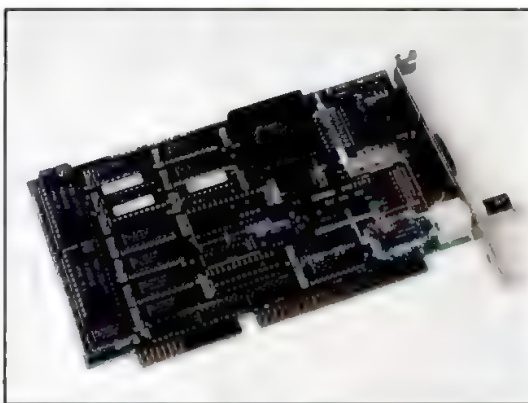
Watch for Artisoft's **Central Station™**, the new data multiport where portables and peripherals quickly connect in and out of an Ethernet network without disrupting network operations. It won the **Best of Spring Award** for connectivity from the Interface Group and *BYTE Magazine* when it was introduced at Spring COMDEX. Central Station will be available this fall.

Sounds like the future... 21st Century dictation arrives nine years early with introduction of the **ArtiScribe™ digital dictation system**, a network-based voice dictation, delivery and transcription

system featuring voice-activated transcriber controls. **Sounding Board™** is the new name for the improved LANTastic Voice Adapter with SoundPUP, a TSR pop-up voice recorder included in the \$99 price. Both are also available in Micro Channel™ versions.

Products, solutions and bright ideas—now you can connect to Artisoft via **CompuServe®**. As a new member of the PC Vendors Forum, Artisoft now provides you patch files, updated information, even news from our new enduser newsletter, *Peer Energy*. When on-line with CompuServe, simply type **GO ARTISOFT**.

Cup runneth over department: In addition to the third straight *PC Magazine* 1991 Editors' Choice, Artisoft's LANTastic won the **Readers' Choice Award** from *LAN Times* and is *LAN Magazine's* **Product of the Year**. With the most recent *PC Magazine* Editors' Choice, that makes a total of 16 major industry awards since 1987.



Artisoft's AE-3 Ethernet adapter

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ILLUSTRATION DON BAKER



BRIDGES AND ROUTERS

These eight bridges and routers make intelligent decisions about the data they pass between LAN segments and increase the efficiency of busy networks.

Smart Links Between LAN Segments

BY FRANK J. DERFLER, JR., AND STEVE RIGNEY When you need to bridge the gap between two LANs, the range of choices spans everything from e-mail gateways to bulletin board systems to access servers. These solutions are appropriate for many applications, but the real heart of LAN-to-LAN connectivity is perhaps found in the bridges and routers that establish connections over long-distance lines.

Bridges and routers earn a premier position in the LAN-to-LAN arena because of their ability to evaluate

the Ethernet packets and Token-Ring frames going by, and to distinguish those that should be transmitted to another LAN via the transport media from those that should not. The means to this end is different in each category, and the solution that will prove most effective in your computing environment depends on various factors, including the network protocols in use on each network and the number of nodes per LAN.

These products move your data in real time without requiring users to run programs or do anything else to make the connection happen. Just as LAN hardware and software make a printer in the next office respond as if it were on your desk, bridges and routers make network resources across town or across the country respond as if they were local. For example, an end user who has access to his

or her local C: drive and the local area network D: drive can also access a drive on a distant LAN segment as his or her E: drive by means of a bridge or router.

BRIDGES, ROUTERS AND OTHER OPTIONS

There are other options besides bridges and routers for connecting your LANs. Linking LANs requires some device on each network segment to act as the interface between the high-speed LAN cable and the typically slower long-distance link. This interface device can include the hardware needed to translate between the different electrical signaling techniques used on the two connection systems, as well as the software to look inside the packets or frames to check them for validity and

perhaps for destination. Since you're likely to pay thousands of dollars per month for the long-distance circuits you use to link LANs, it makes sense to buy the right interface equipment so that you can make the most efficient use of the expensive internetwork links. These links can consist of anything from T1 lines, which typically provide point-to-point connectivity, to X.25 networks (generally most useful for multipoint communications), to ISDN and Switched 56 services. (For more information on some of these links, see the article "The Media Move the Message" in this issue.)

The interplay of options, costs, reliability, and needs has driven the development of four different categories of interface devices: repeaters, bridges, routers, and gateways. Each category of products has specific capabilities, costs, and archi-

GLOSSARY: Bridges and Routers

by Frank J. Derfler, Jr.

■ **bridge**

An interconnection device that can connect LANs using similar or dissimilar media and signaling systems such as Ethernet, Token-Ring, and X.25; it operates at the data-link layer of the OSI model. Bridges sometimes work within a PC and sometimes within a special-purpose computer. Bridges read and filter data packets and frames, passing the traffic only when the address is on the same segment of the network cable as the originating station.

■ **brouter**

A device that combines the functions of a bridge and a router. It has the ability to route one or more protocols, such as TCP/IP and XNS, and bridge all other traffic.

■ **data-link layer**

The second layer of the OSI model. Protocols functioning in this layer manage the flow of data leaving a network device and work with the receiving station to ensure that the data arrives safely.

■ **gateway**

A shared portal between a local area network and a larger information re-

source, such as a large packet-switched information network or a mainframe computer.

■ **Internet Packet Exchange (IPX)**

NetWare's native LAN communications protocol, used to move data between server and/or workstation programs running on different network nodes. Ethernet packets or Token-Ring frames encapsulate and carry the IPX packets.

■ **Internet Protocol (IP)**

Part of the TCP/IP family of protocols describing software that tracks the Internet address of nodes, routes outgoing messages, and recognizes incoming messages.

■ **Open Systems Interconnection (OSI) reference model**

A model for networks developed by the International Standards Organization (ISO). It divides the network functions into seven connected layers, with each layer building on the services provided by those under it.

■ **repeater**

The simplest type of LAN interconnection device. A repeater moves all received packets or frames between LAN

segments. The primary function of a repeater is to extend the length of the network media.

■ **router**

An interconnection device, similar to a bridge, that serves packets or frames containing certain protocols. Routers send packets or frames onto the right links to take them to their destinations; they link LANs at the network layer of the OSI model.

■ **session layer**

The fifth layer of the OSI model, which sets up the conditions whereby individual nodes on the network can communicate or send data to each other. The session layer's many functions include network gateway communications.

■ **Spanning Tree Algorithm (STA)**

A technique based on an IEEE 802.1 standard that detects and eliminates logical loops in a bridged network. When multiple paths exist, STA lets a bridge use only the most efficient one. If that path fails, STA automatically reconfigures the network to make another path become active, sustaining network operations. This algorithm is used mostly by local bridges; it is not eco-

tures associated with it.

In addition to those categories, these products are also categorized as *internal* and *external*, and sometimes as *local* and *remote*. The terms *internal* and *external* denote whether the product resides inside a PC or inside an external standalone box. The terms *local* and *remote* indicate whether the product connects local high-speed LAN segments (that is, segments within a few thousand feet) or uses a long-distance line to a remote site a few miles or a few thousand miles away.

REVIEW CRITERIA

This review focuses on two categories of products: bridges and routers. Our editorial filter specified that the bridges and routers had to be capable of being installed inside a PC and working over long-distance lines. That is, they had to be

nomical for use over leased telephone circuits connecting remote bridges.

■ Transmission Control Protocol (TCP)

A specification for software that bundles outgoing data into packets (and unbundles incoming data), manages the transmission of packets on a network, and checks for errors.

■ transport layer

The fourth layer of the OSI model. Software in the transport layer checks the integrity of and formats the data carried by the physical layer (layer 1, the network wiring and interface hardware), managed by the data link layer (layer 2, described above), and perhaps routed by the network layer (layer 3, which contains the rules determining the path to be taken by data flowing through a network).

■ Xerox Network Services (XNS)

A multilayer protocol system developed by Xerox and adopted, at least in part, by Novell and others. XNS is one of the many distributed file system protocols that let network stations use other computers' files and peripherals as if they were local.

internal remote bridges and routers.

We evaluate Eicon Technology's Eicon Router for NetWare, Gateway's G/X25 Gateway & Bridge 64, Microcom's LAN Bridge 6500 and LAN Bridge 6000, Newport Systems Solutions' LAN²LAN Router, Novell's NetWare Link/X.25 and NetWare Link/T1, and Performance Technology's POWERbridge package. Each product consists of hardware in the form of a communications adapter for the particular connection scheme and software for the particular function. The hardware and software products making up each of these products can be sold separately or in combinations other than the ones reviewed here. The companies generally offer communications adapters with different cables for various connection options. There is also an overlap among some products: Novell, for example, resells products from both Eicon and Newport; Performance Technology bundles the Eicon card with its *POWERbridge* software. While the solutions we discuss are representative of those offered by each company, they can be customized for you in many ways.

The reviewed products range in price from around \$2,000 to over \$5,000. Each serves as a highly flexible way to create a bridge or, more typically, a router. Only the Microcom products are true bridges.

With these products, you can use any 286- or 386-based PC—perhaps a surplus computer from within your organization—locate it physically anywhere on the network, and connect it to the appropriate internetwork circuits. You'll find various combinations of features in the products seen here, including data compression for efficient use of the linking circuits (mostly implemented in software, although Microcom's LAN Bridge 6000 and Newport's LAN²LAN supply the feature in hardware), alternatives for using data connections of better than 2 Mbps, support for X.25 packets over circuits of 64 Kbps or faster, and even support for the interesting new frame relay protocols operating at the same speeds. (For more information about X.25 and frame relay, see the article "Reliable Relays" in this issue.)

Persoft makes an interesting bridge that, in combination with NCR's WaveLAN, uses spread-spectrum radio technology to allow PCs to communicate without running cables (see the sidebar

"The Wireless Bridge: Persoft's Intersect Remote Bridge"). Unlike the products we focus on in the main review, which work over long-distance lines, the Persoft product is intended to be used in situations where cable is impractical. Its special application adds to its cost: \$9,990 to link two LAN segments.

To be fair, many organizations use external standalone bridges and routers. These are standalone products that attach to the network, sometimes at a central point like the concentrator of a 10BaseT-wired LAN. These products are not limited to the PC environment. Many companies, including BICC Data Networks, Cisco Systems, Halley Systems, Hughes LAN Systems, Netronix, Newport Systems, Proteon, Racal InterLan, Retix Corp., 3Com, Wellfleet, and the Wollongong Group market external bridges and

.

Data compression

makes for efficient

use of linking

circuits.

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routers, or combinations of the two. These devices vary widely in price, from just over \$3,000 to about \$10,000, depending on the type of connections they make and the management features they contain. We have focused on the internal devices in this review because they are generally more economical and more in line with PC users' interests.

In all cases the communications adapters contain their own processors, typically of the 80186 or 68000 class. This heavy-duty hardware reduces the need for a high-priced PC to act as a host to the router package.

We ran almost all these products over Novell's *NetWare*; the exception was Performance Technology's *POWERbridge* package, which runs over NetBIOS LANs. If your organization is tied to Banyan's *VINES*, which includes built-in routing features via its IP protocol, you can also turn to the company for operating system-specific communications adapters and software that accomplish connections over transport media such as dial-up and leased

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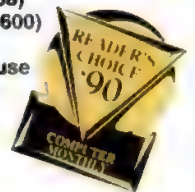
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CONNECTIVITY

BRIDGES AND ROUTERS

lines (see the sidebar "Banyan's VINES: Built-in Routing Makes It an Aptly Named Network").

Some of the products can work with Novell's ROUTEGEN; if they support ROUTEGEN, they generally also support BRGEN, the earlier and misnamed incarnation of ROUTEGEN (misnamed because the software actually *routes* packets between devices) that was shipped in all versions of *NetWare*, including *NetWare 286 2.15* and earlier versions of *NetWare 386*. *NetWare 286 2.2* and *NetWare 386 3.11* use ROUTEGEN, which is not only properly named but better designed and easier to install.

ROUTE GEN (or BRGEN) provides the lower-level program code needed to link one or more LAN and/or communi-

cations adapters in the same chassis through IPX. Bridges and routers use the Novell ROUTEGEN program code to link the LAN adapter and the communications adapter in the PCs they reside in. Note that in addition to the Performance Technology product we review here, some of the other products we look at are also available in versions for NetBIOS networks, where Novell's ROUTEGEN and BRGEN are not factors.

The bridge or router products must themselves supply the higher-level software needed for communications and for handling protocols such as X.25 or frame relay. Similarly, the products must be able to handle the signaling

protocol, usually High-Level Data Link Control (HDLC), typically used over high-speed long-distance communications circuits. Additionally, the adapters must conform to a specific electrical and cabling interface, often the CCITT V.35 standard.

The internal remote bridges and routers described in the reviews offer the ability to grow with new technologies. None of these products is limited or dead-end. But before you read the reviews, you might want a little orientation on the pluses and minuses of the different types of hardware used to link LANS. Let's look at the differences between repeaters, bridges, and routers, as well as gateways, which are explained in the following section.



BANYAN'S VINES: Built-in Routing Makes It an Aptly Named Network

by Kaare Christian

Bridges and routers are attracting more attention from corporate buyers these days because they can be key in the creation of enterprise-wide computing systems. But *VINES* users are probably wondering about all the fuss. Advanced routing features have always formed an integral part of Banyan's *VINES* network operating system.

VINES, priced at \$7,495 for the unlimited-user version, is based on Banyan's low-level IP protocol. With networks, the protocol is everything. Taking inspiration and ideas from Xerox's XNS protocol and the Department of Defense's TCP/IP protocol, Banyan crafted IP to balance the needs of individual LANs while facilitating LAN-to-LAN communication. Banyan's IP recognizes that an enterprise-wide computing system is the sum of its departmental LANs.

Banyan bolts local routing support onto the engine block of every *VINES* server. Every time a *VINES* server comes up, it broadcasts its own routing information to all other servers to which it is attached. This no-hassle technique allows all connected LANs at a single site to work like one big LAN automatically. Logic in each server dynamically maintains the routing tables and chooses the most efficient route for each message.

VINES also supports WAN routing. With WANs, your first decision will be what type of remote transport to use; you should base it on comparative volume and cost. *VINES* supports asynchronous dial-up lines, asynchronous and synchronous leased lines, HDLC, X.25, V.35, and connections to several specialized routers. To use any of the above, you need to purchase a \$1,495 *VINES* ICA (Intelligent Communications Adapter) board for each end of the conversation: For X.25 support you will need Banyan's \$2,495 *X.25 Server-to-Server* software; the other choices require Banyan's \$1,695 *WAN Server-to-Server* package. Also remember that optimally using expensive long-distance links with Banyan's WAN options requires careful supervision from management.

Banyan claims that the internet-working ability of its IP protocol greatly facilitates WAN message delivery. Your primary concern when connecting your New York office to your San Francisco office is throughput; how long it takes to ship a fixed amount of data. But what you buy from your telecom carrier is bandwidth. Getting

the most throughput from a bandwidth depends on the efficiency of your network software, which in turn depends on the efficiency of the underlying protocol. According to Banyan, the IP protocol delivers this efficiency.

The other advantage of Banyan's single-vendor approach to LAN and WAN routing is its lack of finger-pointing. When something goes wrong, the finger clearly points to Banyan. This can be a big advantage when you are responsible for ensuring that mission-critical communications in your organization do not break down. ■

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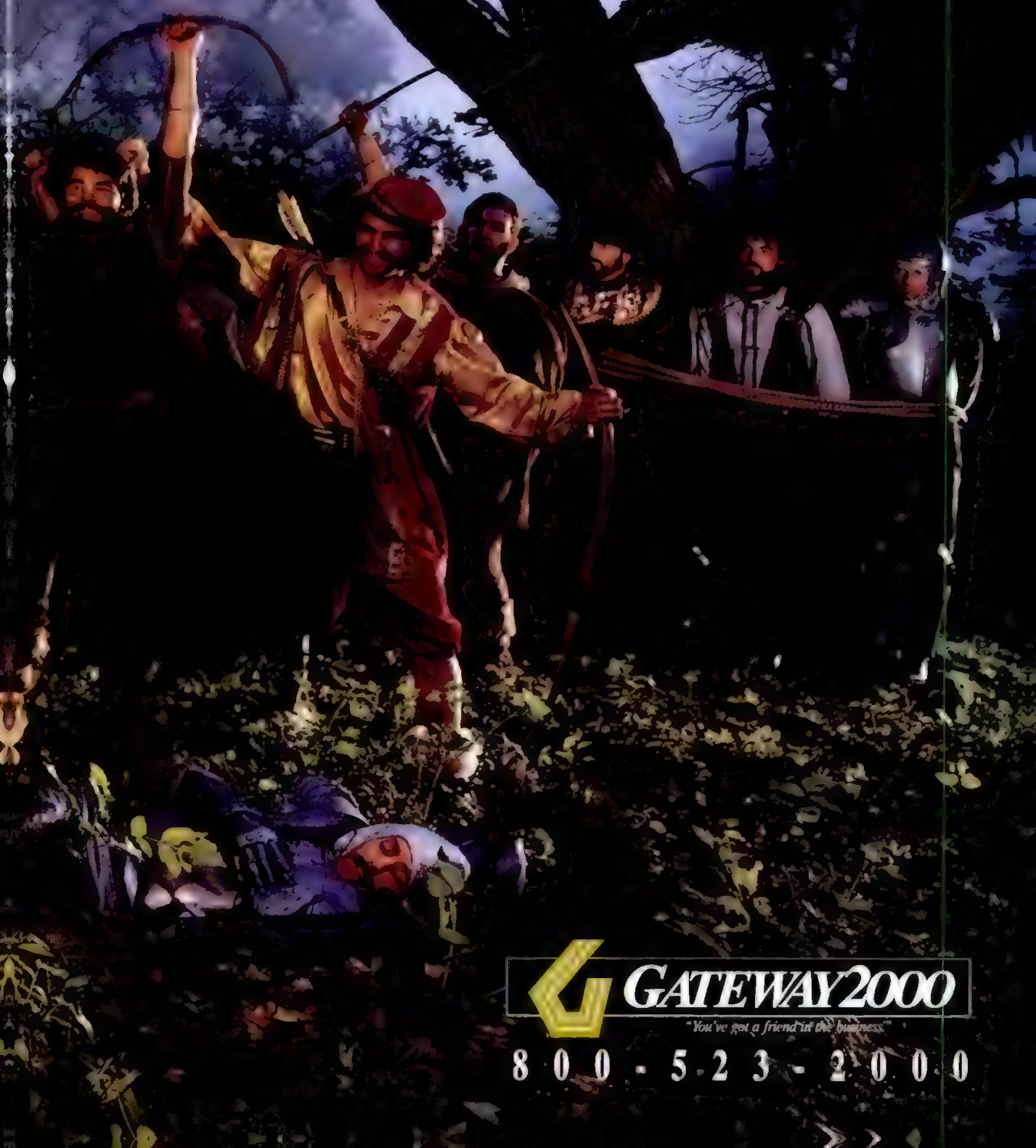
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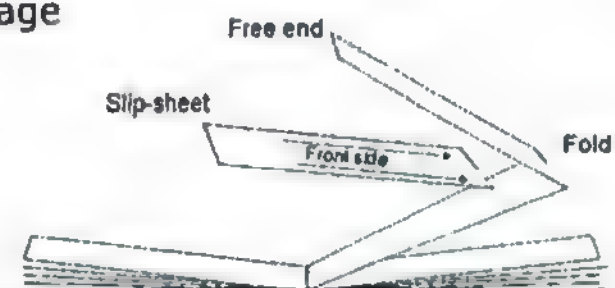
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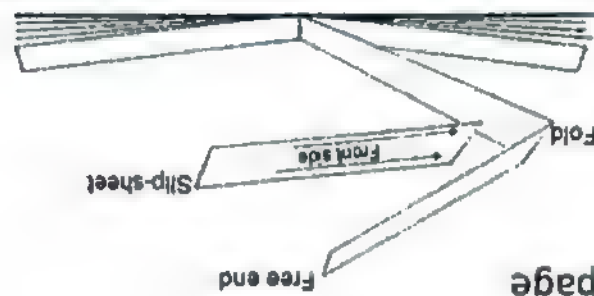


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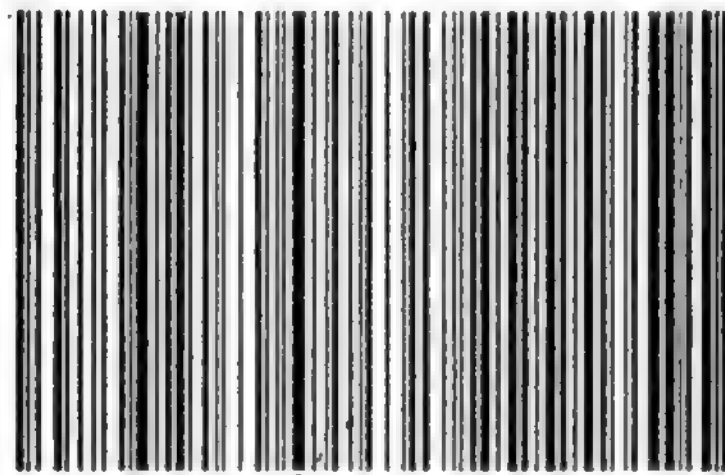


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1. Follow instructions on the other side

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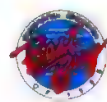
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TELLING THE CATEGORIES APART

The definitions of repeaters, bridges, routers, and gateways are entwined with the concepts of the layers of network functions and the handling of packets of data. *Repeaters* are relatively simple devices that pass all traffic in both directions between the LAN segments they link. Repeaters don't discriminate. They're primarily hardware devices that relay everything they receive. The repeater's function is to extend the network cable beyond the normal limits. For example, a repeater will allow you to create an Ethernet network of several thousand feet, much more than the typical limit of less than 1,000 feet, because the repeater retimes the packets and reinserts them into each cable segment. In effect, the process begins again at each segment.

A *bridge* contains software that exercises some discrimination over what packets pass between the LAN segments. *Routers* contain more-powerful programs that decide what paths the packets will take as they flow between LAN segments, as well as which packets even get to go. Routers gather the information needed to make these decisions by reading elements within the packets; they even keep track of the performance of the alternative paths between the LAN segments.

People often define the differences among repeaters, bridges, and routers in terms of the International Standards Organization's (ISO) Open System Interconnection (OSI) model. Repeaters function at the physical layer of the model. They cannot handle the address or network-control information put into the packets by software operating at the higher layers. Bridges can read station addresses and make decisions based on those addresses, so they are said to operate at the media access control (MAC) sublayer of the data-link layer of the ISO model—the phrase *MAC-layer bridge* is common. Routers make more-sophisticated decisions based on the contents of the packets and on information they gain from the network itself. They work at the network layer of the ISO model.

LAN gateways translate data formats and open sessions between application programs, so they operate at the highest layers of the OSI model. In this issue we describe a number of electronic-mail LAN gateways; in those instances, the modem and PC form the hardware element of the gateway. The classic IRMA card is another example of LAN gateway hard-

ware. A common type of gateway links the PC-based LAN to a device using a completely different data alphabet and signaling system, such as IBM's SNA communications system for mainframe computers.

While these are the classical definitions of these repeaters, bridges, routers, and gateways, companies have created products with features that exceed the

.
**Client PCs do not
need special software
or hardware to
benefit from bridges.**
.

definitions and confound those who like clean classifications. For example, we'll describe a *brouter* that combines the features of a bridge and router in certain installations.

WHEN DO YOU USE...

Each of these products has different uses. You'd typically choose a repeater to link LAN segments when there isn't much traffic on either segment, when the link between the segments is very fast, and when equipment cost and not connection cost is the primary consideration. Because of these factors, repeaters are typically local devices. You normally use one repeater to connect two high-speed LAN segments directly instead of using two repeaters to connect two LAN segments over a slower long-distance line.

Repeaters, with costs ranging from just under \$1,000 for simple Ethernet equipment to well over \$2,000 for Token-Ring devices, are generally less expensive than other linking devices and easier to install. They're useful because they can connect different types of physical media, such as coaxial, fiber-optic, and twisted-pair cables. Note that a repeater cannot translate the packets and frames between Ethernet, ARCnet, and Token-Ring, but it can move Ethernet packets, for example, between different types of cabling. On the down side, all the traffic generated on each LAN segment connected by repeat-

ers appears on all LAN segments, so the network segments can become very busy. Also, certain kinds of problems on one segment, such as malfunctioning adapters that send out improperly formed packets, can affect all segments.

BRIDGING THE LAN

You select a *bridge* when you need to link LANs, either locally or remotely, and you are concerned about loading each LAN segment with unnecessary traffic. Bridges discriminate between the packets or frames they pass, and they move only those packets and frames across the link that are addressed to nodes on the other LAN segment.

Like repeaters, bridges can move packets or frames between different kinds of media. Similarly, this action is invisible to anyone using the network. The client PCs do not need any special software or hardware to benefit from the actions of repeaters and bridges.

Bridges learn. Their software sends out a broadcast message that generates a reply from all network nodes. The bridge software reads the source address of each packet or frame and associates source addresses with LAN segments in an internal table. The bridge software uses this table to limit the traffic crossing between LAN segments and to prevent problem packets or adapters on one LAN segment from affecting connected segments.

If the bridge receives a packet or frame for an as-yet-unidentified destination node, it forwards the packet or frame until the destination replies. This is known as *forward-if-not-local logic*.

Modern bridges are important network management devices. Because they monitor the traffic so closely, special software in the bridges can furnish information on both traffic volume and network errors. However, bridges are busy devices; they must evaluate packets on-the-fly. Communications adapters with on-board processors handle the load efficiently when bridge activity is combined with a lot of reporting.

The learning bridge works well in the role of linking two LAN segments. The process becomes more complex when multiple LAN segments are linked together, either directly in local connections or remotely through long-distance circuits. If multiple LAN segments are connected through bridges, either across a backbone or in a serial cascade, then extraneous traffic must pass through one or



PASSING PACKETS: HOW BRIDGES AND ROUTERS LINK LANs

Like the multiple envelopes in a wedding invitation, packets of information nestle within each other as they move across and between local networks. This relatively simple diagram shows a classic Ethernet packet (not conforming to the slightly more complex IEEE 802.3 standard) wrapped around an IP packet, which in turn shelters a TCP packet. Each part of each packet is composed of a certain number of bits or bytes.

The information in the Ethernet packet tells any Ethernet adapter the identity of the source and destination stations. Bridges read the source address in each Ethernet packet and use it to build a table of information showing the locations of network nodes. They read the destination information to determine whether to pass the packet out to the internetwork circuit. If, for example, the bridge is attached to an X.25 network, it will

encapsulate the entire Ethernet packet in the X.25 "envelope" and pass it over the network. The receiving LAN must use the Ethernet format, although it can use any type of wiring. The bridge pays no attention to the contents of the **data field** in the Ethernet packet.

The **type field** in the Ethernet packet can tell network nodes that the data field is formatted for *AppleTalk*, *DECnet*, *IP*, *IPX*, and *VINES*, or any

AN EXPLANATION OF TERMS

ETHERNET PACKET

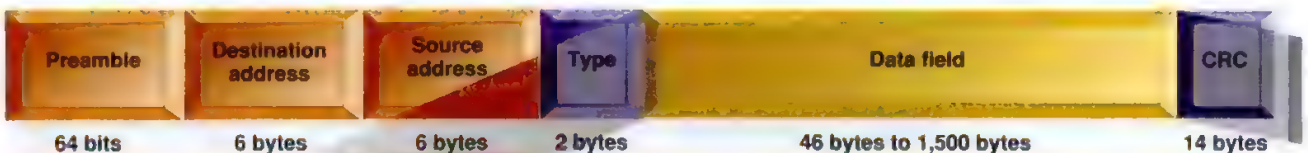
- **preamble** A pattern of 64 bits used for synchronization.
- **destination address** The Ethernet address of the LAN adapter in the node to which the packet is being sent.
- **source address** The Ethernet address of the LAN adapter in the node where the packet originated.

- **type** A code identifying the higher-level protocol used in the data field.
- **data field** The location of all higher-level nested packets.
- **CRC** Cyclic redundancy check, which provides a statistically derived figure used for checking the accuracy of the data.

IP PACKET

- **version** The version of IP in use.
- **header length** The number of 32-bit words before the data field.
- **type of service** This indicates factors such as length of delay tolerated.
- **length** The total size of the IP packet.

Ethernet packet



Checked by a bridge

IP packet within the Ethernet packet



one of many other protocols.

The diagram also shows the breakout of an IP packet contained within the data field of the Ethernet packet. A router, specifically addressed in the **destination address** field of the Ethernet packet, is programmed to look into the IP packet for the address of the destination node. The router then consults its own internal tables and examines variables such as the status of communications

circuits to determine how to send the IP packet on its next hop toward the destination. Each router typically specializes in handling one type of packet format.

In a public data network, the router would discard the Ethernet packet information and encapsulate only the IP information into an X.25 "envelope" for its trip across the wide area network. When the IP packet arrives on the other side, the receiving router

can insert it into a packet in Ethernet, Token-Ring, or some other appropriate format.

The diagram also shows how a TCP packet would nestle within the envelope of the IP packet. In turn, the TCP packet will hold other packets created in a format specific to an application program or to a service running at the session or presentation layer of the ISO model, such as the Simple Mail Transfer Protocol (SMTP).

■ **ID** A 16-bit packet identification created by the originating node.

■ **flag** Settings controlling the permissible fragmentation of this packet during transmission.

■ **frag offset** The position of this packet (or fragment) in the original data.

■ **time to live** The greatest time in seconds that the packet is allowed to exist on the

network. Every device that handles the packet reduces the value of this field.

■ **protocol** The higher-level protocol contained in the data field.

■ **checksum** A statistical analysis of the data in the header, used to check for accuracy.

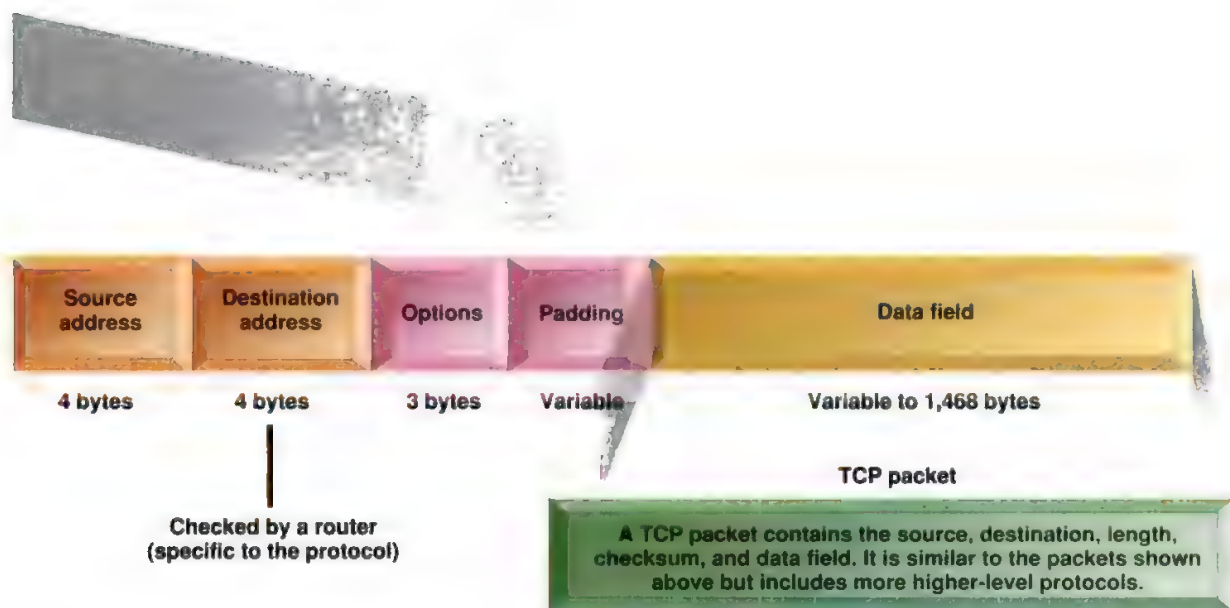
■ **source address** The assigned IP address of the source node.

■ **destination address** The assigned IP address of the destination node.

■ **options** No set parameters for this field, which can be used in various ways by different manufacturers.

■ **padding** Bits used to make the header meet a 32-bit data boundary.

■ **data** The "envelope" holding packets in the format of a higher-level protocol.



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FLAT-OUT-RELIABLE IBM PPS II

more segments as it moves to its destination. This puts an unnecessary load on the intervening segments.

The possibility always exists that somehow multiple LAN segments will be connected by more than one path, perhaps through a dial-up connection, a maintenance connection, or a wiring error. When this happens, it's possible for packets to circulate continuously between the LAN

segments, a situation called a *data storm*. There are several established techniques to handle data storms. The most common technique, adopted by the IEEE 802.1 NetWork Management Committee, is called the *Spanning Tree Algorithm*. Software conforming to this algorithm can sense the existence of multiple paths and

shut one down. Since the technique is not economical for use over long-distance circuits connecting remote bridges, products supporting this algorithm are primarily local bridges. You should be familiar with the phrase, however, since it's commonly used in literature describing bridges.

Similarly, you'll hear about techniques called source routing and protocol-transparent routing used by remote bridges.

Source routing is used primarily in Token-Ring networks. After receiving a message from a source station bound for a destination on another LAN segment, a source-routing bridge sends a test message to the destination station, including its own address with the message. The destination station then sends a message back, containing a full list of all the intermediate bridges. The bridge uses this information to build a map of the interconnected network and determine the fastest path between source and destination nodes.

Protocol-transparent routing uses the forward-if-not-local logical operation described earlier. If the bridge receives a packet or frame for an as-yet-unidentified destination node, it forwards the packet or frame until the destination replies.

ROUTERS DO MORE

Bridges are smart but relatively single-minded. They read and examine and make a decision about every packet or frame (even those not addressed to them). But then they either pass the traffic or ignore it. They can handle data only in homogeneous packets, such as IPX or NetBIOS. Routers are smarter and more discriminating. The software in a router reads complex address information and makes decisions on how to route the data across multiple internetwork links. They don't examine every packet or frame, only those specially addressed to them.

The programs in some routers always pick the shortest path between the two points. These are known as *static routers*. Because the routing information is entered manually, static routers require a lot of attention from a skilled manager. The more-sophisticated products, known as *dynamic routers*, make packet-by-packet decisions based on the information they glean from other routers and network devices about the efficiency and reliability of different routes between the source and destination nodes.

Because routers don't read every net-



EDITORS' CHOICE

- LAN²LAN Mega Router
- Microcom LAN Bridge 6000

Of the eight bridges and routers we reviewed, two products have the throughput, features, and flexibility it takes to make the best use of your long-distance lines: the Microcom LAN Bridge 6000 and Newport Systems Solutions' LAN²LAN/Mega Router. Although priced higher than most of their competitors, these products offer on-board data compression, which significantly enhances throughput.

Microcom fully understands the technology of internetwork communications between LAN segments using the same architecture. Though the \$4,999 MLB 6000's only competition in the MAC-layer bridge category is the company's own MLB 6500, its general excellence would have made this product a clear winner even if there were dozens of other entrants in the field. On our benchmark tests, the Microcom product took top honors for transferring a compressible file, courtesy of an additional on-board processor dedicated to data compression. Its adeptness at data compression shouldn't come as a surprise. After all, the folks at Microcom invented the MNP series of error-correction and compression protocols.

Microcom's software literally installs itself. A big plus for *NetWare* users is that it avoids running Novell's complicated BRGEN or ROUTEGEN programs. In addition to the product's support of the HDLC signaling protocol for connections over high-speed links,

the software detects troublesome problems such as looping. It features handy statistical reports, as well as the ability to access statistics from any PC on the network using the *Carbon Copy Plus* program included in the bundle.

ANOTHER WINNER

The LAN²LAN/Mega Router is the most efficient and effective way to link *NetWare* LANs that do not have the same MAC-layer architecture. It's also the choice if you want to control packets based on addresses contained in IP, IPX, NetBIOS, or other network layer software.

In its tested configuration, the \$5,195 LAN²LAN communications adapter was coupled with the company's optional \$1,595 daughterboard card that features a second processor for data compression at speeds up to 128 Kbps. Its on-board compression and impressive data-handling capabilities raise the product above other candidates in the router field. LAN²LAN provided top-of-the-line throughput on our compressible file tests, besting all the other routers by a significant margin. Another highlight of the product is a management program, driven by menus and function keys, that simplifies the process of diagnosing internetwork problems. The flexibility from the package's support for both the X.25 and HDLC protocols is also most welcome.



When you look at windows, it's not always clear what's behind them.

PC-mainframe software and a Windows interface is an ideal combination. After all, by making programs look similar, a graphical user interface makes them easier to learn and use.

But that can be a problem when you're evaluating software. After all, if programs look alike, how do you know which one is the standout?

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CONNECTIVITY

BRIDGES AND ROUTERS

work packet or frame, they don't work as hard as bridges; hence they put less of a load on the host CPU. Because they allow only specially addressed packets and frames to pass between LAN segments, they put the lowest stress on the internetwork links and do not pass any bad data. We described bridges as using forward-if-not-local logic. Routers use a logic best described as forward-if-shown-remote. They pass traffic over the internetwork link only if the network address shows that it is not destined for a local node and that the address is known.

The internetwork long-distance links are expensive and, because routers strip off the MAC-layer address information before they send a packet across the internetwork link, they use the link more efficiently than bridges. If you pass a lot of short packets or frames across an internetwork link—keystroke entries, for example—the MAC-layer address can take up as much as 50 percent of the packet. Some routers use a compression algorithm in their software to improve the throughput further. On-the-fly compression is a tricky thing. In general, compression is useful over slower or very crowded communications circuits, but if the circuits are fast, then it takes longer to run the compression software than it does simply to send the data across without compression. In internetwork links, companies like Eicon Technology believe that circuits with speeds over 64 Kbps do not benefit from compression.

Routers do not hold tables describing each node and associated LAN segment the way bridges do. They only know about other routers that are identified by a subnetwork address. The routers do not care what format the packet or frame is in. They only read the subnetwork address, decide on the route, and perhaps wrap the packet or frame in an appropriate envelope, such as an X.25 or frame relay packet. Nevertheless, the data packets or frames sent to the router must conform to specific network-layer protocols. Vendors sell routers conforming to the DECnet, IP, IPX, OSI, XNS, and many other protocols. Companies such as Cisco Systems, Proteon, and Wellfleet sell multiprotocol external routers that allow you to combine protocols like IP and DECnet in the same network. The Wollongong Group sells an effective router combining the NetWare IPX protocol and the IP portion of the TCP/IP protocol. But there are no standards for these multiprotocol routers; in-

teroperability between products from different companies could be a problem.

SELECTING AN ARCHITECTURE

In an effort to differentiate their products, some companies market devices with the attributes of both bridges and routers, known as *brouters*. Halley Systems, for example, sells an external brouter. Typically, a brouter performs the full routing function for one protocol like IP or XNS and acts as a bridge for all other packets on

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**Bridges and routers
are the prime portals
for internetwork
connectivity.**

.....

the network. Obviously, these products are useful in organizations that combine different packets of different types on the same integrated network. A brouter would be valuable when you try to mix several homogeneous LAN segments in with two very different segments that you need to pass data between.

All these products are complex, and every installation is different, but there are some rules for selecting among repeaters, bridges, routers, and gateways that usually hold true. First, the communications line is an expensive and limited resource. Do everything you can at the equipment end to limit the traffic on the long-distance line. This can and often does mean using a router on long-distance internetwork circuits.

If you connect LANs by using high-speed links within a building or across a campus, then the choice is not as clear. The architecture should be based on how much isolation you need for each LAN segment and the organizational culture. If the organization is highly structured, then you'll probably choose routers, or even devices such as electronic mail gateways, because of the way they clearly define each LAN segment as a subnetwork. But if you have what's known as an open organization, and you've invested in your own high-speed local circuits, then bridges

or even repeaters might meet your needs.

In many organizations, people face the problem of how to link their LAN segments. More than repeaters—and in the same class as gateways—bridges and routers are the prime portals for internetwork connectivity.

EICON TECHNOLOGY CORP. **Eicon Router for NetWare**

All reviews by M. Keith Thompson

.....

Eicon's routers for PC LANs combine flexibility and reliability. The company markets software to work over many types of connections, including Switched 56, X.25, frame relay, and fractional T1, using the same communications adapter. Eicon's HSI (high-speed interface) card, along with the proper cable, can provide an interface with each of these types of circuits. At \$2,090, the Eicon Router for NetWare package, which we tested, provides a cost-effective solution for many organizations. Eicon also markets routers for NetBIOS networks.

The Eicon Router comes as a complete hardware/software combination; you can



Eicon Router for NetWare

Eicon Technology Corp., 2196 32nd Ave., Montreal, Quebec H8T 3H7 Canada; 514-631-2592.

List Price: \$2,090 (software, \$995; hardware, \$1,095).

Requires: 286-based PC or better, 384K RAM, NetWare 2.1 or later, connection to other LAN, DOS 3.1 or later.

In Short: A good router from a company with years of experience in the X.25 market, the Eicon Router for NetWare uses data compression at speeds up to 64 Kbps to reduce costs and enhance throughput. It offers an acceptable combination of price and performance and operates over a variety of links.

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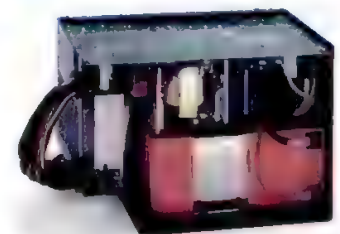
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CONNECTIVITY
BRIDGES AND ROUTERS

also buy the hardware for \$1,095 and the software for \$995. The HSI/PC card installs in a 286-based PC or better. Eicon supplies cables to connect to a modem, multiplexer, or PAD. The package includes *Router for NetWare* software, which supports the X.25 and frame relay protocols.

The Eicon HSI WAN card includes ample processing power to handle large numbers of packets. It uses a 16-MHz 68000, includes 1MB of RAM, and offers

flexible connection options. You can configure the HSI card to act as an RS-232, V.35, or X.21 port. These connection standards allow you to couple the HSI card to various types of WAN termination equipment, including multiplexers, Switched 56 interface equipment, and modems.

For speeds up to 64 kilobits per second (Kbps), the X.25 and frame relay software

uses a variable compression algorithm to increase throughput. The routine dynamically compresses data, allowing the system to get more data in the packet and move fewer packets across the internetwork link. Since PDNs typically charge for the number of packets sent, you can reduce the cost of the PDN service and perhaps avoid the need for higher-speed internetwork circuits.

Eicon's X.25 software supports up to 254 virtual circuits through the PDN, allowing users and devices on one local network to establish as many as 254 simultaneous sessions with other local networks. The Eicon Router is a true IPX dynamic router: IPX packets destined for a remote location are routed to the other LANs through the internetwork link. The router intelligently and automatically learns the home segment of the stations on the networks and routes packets accordingly, eliminating extra traffic and cost.

READY FOR FRAME RELAY

The Eicon Router supports the emerging frame relay protocol for faster data throughput over private data networks and, once they begin to support frame relay, public data networks as well. Frame relay is similar to X.25 but requires about 30 percent less overhead in real-world transmissions. At press time, no phone company or on-line service offered frame relay service, but several planned to add it soon. And since many companies have their own private networks and the cost of small frame relay switches is relatively inexpensive, this technology can save you money now.

In our Noncompressible File Throughput test, the Eicon Router displayed sturdily average throughput with both the X.25 and frame relay protocols. Using both protocols at 56 Kbps on the Compressible File Throughput test, it had acceptable midrange scores. On our testbed, there was a throughput advantage for frame relay over X.25, although not a significant one. But we performed relatively simple tests across a single piece of cable. The HSI/PC card's maximum data rate totals 200 packets per second, or 384 Kbps.

Although the Eicon Router uses Novell's BRGEN software, Eicon's documentation helps eliminate some of BRGEN's frustrating configuration and disk-swapping procedures. The instructions contain sample screen shots and helpful hints to make installing a *NetWare* router easier.

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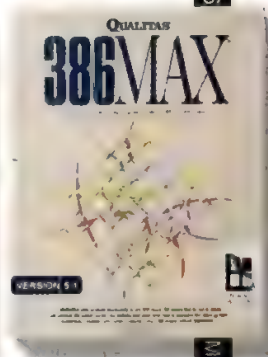
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CONNECTIVITY BRIDGES AND ROUTERS

The configuration program, driven by function keys, works quickly. But installation still is not a trivial job, even if you use Novell's newer ROUTEGEN instead of BRGEN. You should plan on spending some time and effort.

Hardware installation is straightforward; the default settings work for most installations. But if you need to change the I/O address or IRQ setting, the documentation again includes clear instructions.

Once you get it operational, the Eicon Router requires little attention. But since the management software included in the package is not menu-driven, the system administrator needs to type in command line statements to send instructions to the program, or create batch files to perform regularly executed functions, such as dialing a specific DTE (data terminal equipment) address across an X.25 network.

Eicon's X.25 router can handle multiple protocols concurrently. When attached to an X.25 network, the HSI card can route NetBIOS and IPX packets simultaneously. The software needed to perform the second routing function, a \$995 option (which we did not review), runs on another networked computer.

STATISTICS SCREENS

Eicon's statistics screens display a variety of helpful information, including the router's current status and useful error messages that assist in troubleshooting inter-LAN problems. The screens also show data on packets sent and received,

.

**Once you get it
operational, the Eicon
Router requires little
attention.**

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connection type and time, and response time. Network managers can access this information from any computer on the network.

Eicon offers technical support over a toll line from 8:30 to 5:00 E.S.T. weekdays. The Eicon Router provides a com-

plete solution for LAN-to-LAN routing; Eicon's versatile connection options offer workable solutions for many types of organizations. The Eicon Router for NetBIOS costs the same as the Eicon Router for NetWare and works on all NetBIOS networks compatible with *LAN Manager*, Version 1.1 or later. Whatever the amount of traffic on your networks or your communications budget, the Eicon Router makes connections.

GATEWAY COMMUNICATIONS INC. G/X25 Gateway & Bridge 64

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Like many products in this category, Gateway Communications' G/X25 Gateway & Bridge 64 is partially misnamed. It qualifies as an X.25 gateway, but the hardware/software combination is not a bridge; it's a router that works on *NetWare* and NetBIOS-based LANs. Gateway's product operates over a PDN and works well in fractional T1 installations. It does not attain the full 1.544 megabits per second (mbps) available on a U.S. T1

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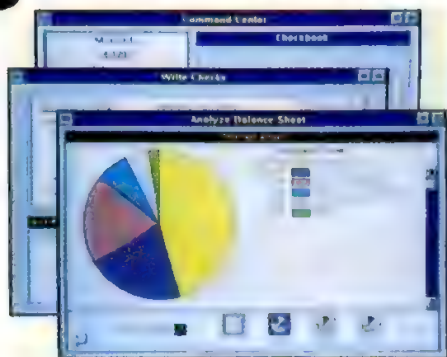
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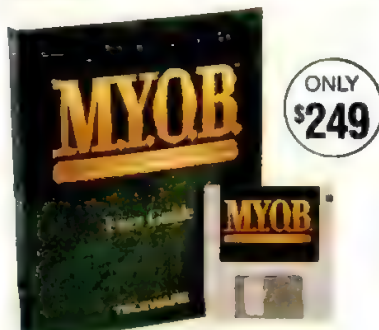
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CONNECTIVITY

BRIDGES AND ROUTERS

WAN termination equipment.

Gateway's WNIM 186 adapter card offers a maximum data rate of 60 packets per second on a 64K line with 256-byte packets. Its maximum connection rate is 64 Kbps.

BRGEN HEADACHES

The G/X25 Gateway & Bridge 64 uses Novell's BRGEN or ROUTEGEN software. If you are fortunate enough to have the latter, installation will not take as long, but it still will not be a no-brainer. You can save anywhere from a half hour to several hours by using ROUTEGEN, depending on how much trouble BRGEN tends to give you. If you only have BRGEN, installation requires many disk changes and leaves room for potential problems.

Installing the hardware is easier. As with the Eicon product, the default settings should work in most cases, but the documentation provides clear advice in case you need to change an IRQ setting or I/O address.

Once it's set up, you do not need to worry much about the G/X25 Gateway & Bridge 64; it just sits there and works. With simple menus, system administrators can change system information and make calls to other networks on the PDN. The software displays each network in your directory with its DTE (data terminal equipment) address. You call a network simply by highlighting it on the menu and pressing Enter.

The G/X25 Gateway & Bridge 64 is a dynamic IPX router. It learns which packets to pass and the best path to the destination. The product can also route NetBIOS and XNS packets. The statistical screens, accessible from any station on the network, display useful information about network traffic.

THROUGHPUT AND SUPPORT

On our Noncompressible File Throughput test, the G/X25 Gateway & Bridge 64 showed below-average throughput using the X.25 protocol. But on a compressible file it achieved 34.79 Kbps at 56 Kbps, a speed more in line with the midrange of our results.

The first line of support for the G/X25 Gateway & Bridge 64 is your dealer, but Gateway also provides support via a toll line from 6:30 to 5:30 P.S.T.

Gateway Communications has years of experience with gateways and routers.

The G/X25 Gateway & Bridge 64 offers a workable solution for LAN-to-LAN routing and doubles as an X.25 gateway. While not the best or fastest on the market, Gateway's product is very reliable and a good choice for a company wanting both gateway and router connectivity.

MICROCOM SYSTEMS INC.

Microcom
LAN Bridge 6000
Microcom
LAN Bridge 6500

• • • • •

Microcom Systems' line of Microcom LAN Bridge products can provide LAN-to-LAN connectivity over a variety of internetwork links, including X.25, ISDN basic rate interface, T1, and leased-line long-distance circuits. Microcom sells the \$3,999 Microcom LAN Bridge 6500 reviewed here as a complete kit that includes the media access control layer (or MAC-layer) bridge software, software support for X.25 protocols, a Microcom



G/X25 Gateway & Bridge 64

Gateway Communications Inc., 2941 Alton Ave., Irvine, CA 92714; 800-367-6555, 714-553-1555.

List Price: \$3,495.

Requires: 286-based PC or better, 384K RAM (server, 256K RAM), 512K EMS memory, NetWare 2.1 or later, connection to other LAN, DOS 3.0 or later.

In Short: A dual-function product designed for flexible communications needs, the G/X25 Gateway & Bridge 64 can serve as a gateway or a router. While not a speed demon, it serves as a reliable solution to LAN-to-LAN connectivity problems.

CIRCLE 605 ON READER SERVICE CARD

channel, but it can run at 64 kilobits per second, the standard for one fractional T1 channel.

The \$3,495 package, which includes a WNIM card and X.25 software, provides a good LAN-to-LAN solution. As an X.25 gateway, it provides features unavailable in bridges or routers: It lets users on the network share access to a PDN and connect to other services (such as CompuServe or MCI Mail) from their PC without their own modems or X.25 links.

You can install Gateway's WNIM 186 card in an 80286-, 80386-, or 80486-based computer. The package includes cables for connections to a multiplexer, modem, or PAD. As with the Eicon router, the software's variable compression algorithm lets you increase throughput at speeds up to 64 Kbps. Because it compresses data on the fly, its benefits grow with expensive data lines. But while Eicon can have 254 virtual circuits, Gateway's X.25 software supports no more than 16, which limits network users and devices to a maximum of 16 simultaneous sessions with other networks through the PDN.

The 10-MHz 80186 processor and 512K of RAM in Gateway's WNIM 186 card give the product adequate processing power to handle many packets. Like the Eicon card, you can configure its port to conform to the RS-232, V.35, or X.21 specifications and link it with a variety of



Microcom LAN Bridge 6000

Microcom LAN Bridge 6500

Microcom Systems Inc., 500 River Ridge Dr., Norwood, MA 02062; 800-822-8224, 617-551-1000.

List Price: MLB 6000, \$4,999; MLB 6500, \$3,999

Requires: 286-based PC or better, 512K RAM, any Ethernet network, connection to other LAN, DOS 3.0 or later

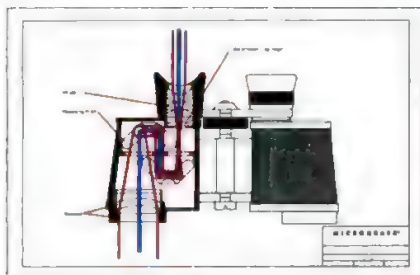
In Short: Microcom's easy-to-use and easy-to-install MAC-layer bridges have the advantage of being able to operate over all network operating systems without distinguishing among the higher-level protocols on the network. The MLB 6000 offers particularly speedy operation at high speeds; it also offers some of the finest software for system administrators and management duties in this category of products.

CIRCLE 606 ON READER SERVICE CARD

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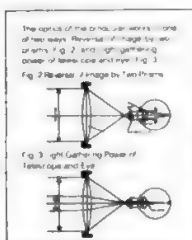


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Ethernet card, and a WAN communications card for use over an X.25 network. We also tested the \$4,999 Microcom LAN Bridge 6000, a package which also includes a WAN communications adapter, Ethernet card, and the MAC-layer bridge software; however, this package supports the HDLC signaling protocol, since the MLB 6000 can run over T1 and fractional T1 links.

Microcom also offers a Token-Ring network adapter for either package, along with cables to connect to many types of communications equipment. The Token-Ring version of the MLB 6000 sells for \$5,499; the MLB 6500 with a Token-Ring card costs \$4,499. Microcom markets a \$5,499 286-based PC with either combination of hardware and software included. This convenient package allows an organization to add a turnkey solution to its network.

Because they are true MAC-layer

bridges and not routers like the other products we reviewed, the MLB 6000 and MLB 6500 can operate over all network operating systems without distinguishing among the higher-level protocols on the network. They do not care if the packets carry DECnet, IPX, TCP/IP, or any other type of data. They just read the MAC-layer address of the destination and decide how to handle the data. You need only the same network topology on both ends to connect, for example, a *LAN Manager* Ethernet network in Seattle with a *NetWare* Ethernet network in Provo.

The MLB 6500 comes as a complete hardware/software kit that provides X.25 bridge services. The WAN card uses a Motorola 16-MHz 68000 chip and includes 576K of RAM. The product offers a 2:1 compression technique, allowing greater throughput and resulting in lower

public data network costs. The MLB 6000 supplies an even better 4:1 compression ratio for its T1 hardware; the WAN card for this product also includes 576K RAM. It also includes two processors in the Motorola 68000 family and two custom integrated circuits to handle compression and communications. Both products stop compressing data at 64 Kbps.

As an X.25 bridge, the MLB 6500 operates at a maximum of 64 Kbps, or 500 packets per second, and allows the creation of up to 15 virtual circuits through the PDN. The MLB 6000 provides a maximum throughput of 2.048 megabytes per second, or 4,000 packets per second.

On the Noncompressible File Throughput benchmark test at 56 Kbps, the MLB 6500 was on the low side of average. But on our Compressible File Throughput test, it had one of the top three scores. The MLB 6000 produced appropriately fast throughput, getting the best numbers we

THE WIRELESS BRIDGE: Persoft's Intersect Remote Bridge

by M. Keith Thompson

Persoft's Intersect Remote Bridge provides a unique way to link nearby LAN segments across a campus or in a building. Using NCR's WaveLAN network cards, which come bundled with Persoft's *Intersect Bridge* software, it can link Ethernet LAN segments of all types over a limited distance, and do it without wires. With the help of WaveLAN's spread-spectrum network technology, the Intersect Remote Bridge works as a remote MAC-layer bridge, providing connectivity for thick, thin, and twisted-pair Ethernet networks up to approximately 1,000 feet apart. With special antennae, it can go even farther. At \$4,995 per segment (in other words, \$9,990 to link two LAN segments), it's a pricey solution, but it will carry packets where no other remote bridge can. Persoft also markets a local internal bridge for Ethernet, essentially two Ethernet boards back-to-back, for \$1,495.

The spread-spectrum radio technology allows computers to communicate without cables. Each bridge computer has a WaveLAN network card with a built-in radio transceiver and an omnidirectional antenna. The cards pass data in the 900-MHz frequency range with

reasonable throughput, about 670 Kbps. Although this speed is not comparable to a cabled network, it is competitive with the other bridge and router products we reviewed.



Installation is simple. The documentation includes clear instructions on how to set up the network cards. On the software side, you type INSTALL A: B: and *Intersect Bridge* does the rest, prompting you for the original disk and your working copy when needed. Once configured, boot from your working disk and you're up.

Persoft's Intersect Remote Bridge includes all the features of a standard bridge except cables and support for extended distance. It operates trans-

parently with all types of network operating systems. The Intersect Remote Bridge learns packet destinations dynamically and forwards only the needed packets to the other side of the bridge. Persoft's software includes an intelligent algorithm to prevent looping. With a program called TROLL, administrators can limit an individual user's access to the other side of the bridge.

The Intersect Remote Bridge is not for everyone. Its primary market comprises organizations needing to communicate over short distances where cable is impractical and leased PDN lines unacceptable. Persoft provides a solution for this environment, but one with a high price tag. ■

Intersect Remote Bridge

Persoft Inc., 465 Science Dr., Madison, WI 53711; 800-368-5283, 608-273-6000.

List Price: \$4,995 for each unit (minimum of two), \$9,990 for a system to link two LAN segments. Intersect Local Bridge, \$1,495.

Requires: Dedicated AT or better, floppy disk drive, DOS 3.0 or later. Intersect Local Bridge: Dedicated XT or better, DOS 2.1 or later.

CIRCLE 602 ON READER SERVICE CARD

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Upgrade program	Yes	Yes	No
Warranty	Lifetime	Lifetime	One year

* Suggested list price of PacificPage P•E cartridge without a 2 MB memory board is only \$499.



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Edward Mendelson
PC Magazine, (June 25, 1991)

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saw on both compressible and noncompressible file tests at 56 Kbps.

Microcom's *LAN Bridge* software, which it includes with the MLB 6000 and MLB 6500, runs over all of its WAN cards. The cards offer connectivity over dial-up lines, X.25, ISDN basic rate interface, and T1. This gives you an easy upgrade path as your needs expand. You can learn one software program and change the underlying hardware and drivers.

The MLB 6500 also includes the nec-

essary hardware to run the frame relay protocol. As the frame relay market demand grows, Microcom need only ship the software to provide a solution. Users will not need to buy additional boards.

TROUBLE-FREE INSTALLATION

Microcom evidently put a great deal of effort into making the software generation process completely automatic. In-

stalling the MLB 6000 or MLB 6500 could not be easier; the total installation took only moments. Although we set up the products under *NetWare*, the bridges work with all network operating systems. Since you use Microcom's own software, you do not need to worry about running Novell's BRGEN or ROUTEGEN. You simply install the WAN and LAN cards in the computer and type A:INSTALL. You can put as many as four WAN communications cards in the PC that will act as a bridge. The setup program scans the computer for the cards and configures itself accordingly. If for some reason you want to change the I/O address or IRQ setting, the bridge software includes a menu-driven utility to do the job.

Installation and operation are both well-documented; operating the bridges is simple. Each operation is menu-driven, with menu selections also available through function keys displayed on-screen with each selection. This approach allows the system administrator to get reasonably comfortable with the program in a short period of time.

The *LAN Bridge* software included with both products routes data packets between LANs using station addresses specified in each LAN packet. Firmware contained on a daughterboard attached to the network adapter lets the bridges automatically learn the locations of network stations and forward remotely addressed packets.

The *LAN Bridge* software provides statistics, alarms, and configuration data for each port and virtual circuit it uses. The port statistics are divided into two types: LAN and WAN. The program accumulates and displays the statistics as short-term and long-term data, which correspond to the past two minutes and just over an hour, respectively. Data includes valuable information like packets received, transmitted, discarded, and forwarded. If you are a network manager, you can access these statistics from any computer on the network via a remote-control modem connection and a host copy of the company's *Carbon Copy Plus* that comes bundled with both bridges.

Network managers will appreciate Microcom's attention to simple details. The *LAN Bridge* software detects looping caused by two networks inadvertently connected through different virtual circuits. Undetected, this condition could cause internetwork packets to circulate around the network permanently and lead to a huge management headache.

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BRIDGES AND ROUTERS

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BEST ARCHITECTURE

Microcom's software has the best architecture and user interface of all the packages in this review. If you walk up to the computer that acts as a bridge and hit Ctrl-Alt-Del, the software intercepts the request for reset, stores its settings, closes communications sessions in an orderly manner, and then allows the computer to reset. It's nice to see products with this much thought and care behind them.

Both the MLB 6000 and MLB 6500 are reliable, top-quality products with data compression, helpful documentation, thoughtful design, and good price/performance ratios. They make fine choices for anyone needing a MAC-layer bridge over an X.25 or T1 network.

NEWPORT SYSTEMS SOLUTIONS INC. LAN²LAN Mega Router

Newport Systems Solutions' LAN²LAN products offer excellent flexibility, throughput, and ease of use. They can function over Switched 56, X.25, ISDN,

fractional T1, and T1 connections using one communications adapter card. With the proper cable, Newport's WNIC card can connect with each type of circuit. The LAN²LAN/Mega Router works on NetWare 2.1 or later as a router hosted in a networked PC; if you are using NetWare 3.0, you can install the router and its software as an NLM (NetWare Loadable Module) in the server. The communica-

tions adapter and software cost \$5,195; the data compression daughterboard included in the system we tested is a \$1,595 option. The tested configuration for the LAN²LAN/Mega Router, which includes support for both the X.25 and HDLC signaling protocols, was more expensive than the other routers we tested, but it also produced some of the highest throughput numbers we saw.

Like Gateway and Eicon, Newport offers cables for connections to your

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FACT FILE EDITORS' CHOICE



LAN²LAN Mega Router

Newport Systems Solutions Inc., 4019 Westerly Pl., #103, Newport Beach, CA 92660; 800-368-6533, 714-752-1511

List Price: For adapter card, interface cable, utility software, \$5,195, data compression daughterboard, \$1,595

Requires: 286-based PC or better, 640K RAM, NetWare 2.1 or later, connection to other LAN, DOS 2.0 or later

In Short: The LAN²LAN/Mega Router has some of the fastest throughput numbers and the highest price tag of the products we tested. But if you transfer a lot of data, these products could save you a considerable amount of money in data and line charges. It makes a great choice for NetWare-only LANs.

CIRCLE 607 ON READER SERVICE CARD

BRIDGES AND ROUTERS: A Look at the Hardware

by Angela Gunn

The layout of the LAN²LAN/Mega Router's Wide Area Network Interface Co-Processor (WNIC) is typical of bridges and routers, although unique in some respects. In general, communications adapters (as WNICs are generically known) are distinguished by the presence of a processor, memory, and configurable ports.

The Newport unit shown here gets its processing power for handling large numbers of packets from a 10-MHz NEC V50 chip, located on the left side of the board below the 10-MHz oscillator/clock and external four-channel DMA controller. The NEC V50 is compatible with Intel's 80186 instruction set; in fact, the 10-MHz 80186 supplies the processing duties for products like the Eicon Router for NetWare and the Novell Link/X.25. Another processor chip common among these boards is the 16-MHz Motorola 68000.

The boxed-in area near the lower-

left corner shows the on-board dual-ported RAM, 512K in this case. Products such as the Eicon Router include as much as 1MB of RAM. On the LAN²LAN/Mega Router board, programmable read-only memory (PROM) located to the right of the on-board RAM contains a serial number that allows each board to have a unique tracking number and LAN node address.

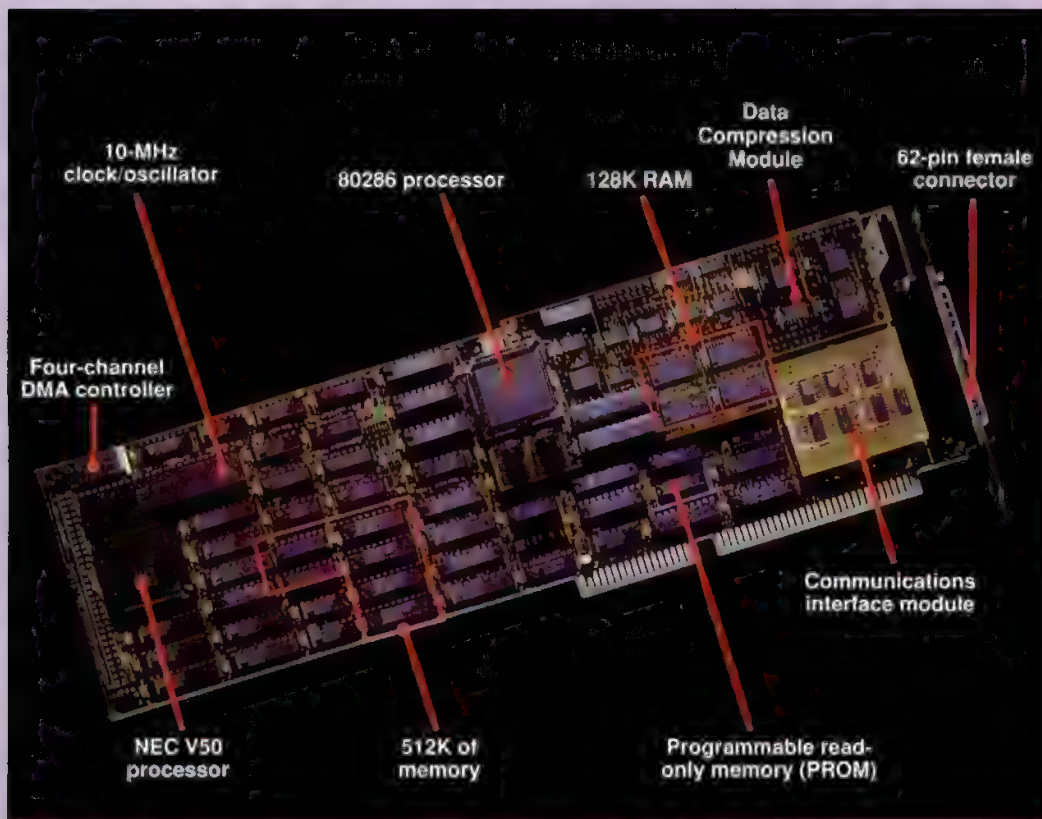
You can typically configure all of the cards we reviewed as any of four ports—RS-232, RS-422, V.35, or X.21—for use with various WAN termination hardware, such as modems, multiplexers, and PADs. In this picture, the 62-pin female connector at right supports 14 interface signals for up to four ports. In some products, the pin configuration is different or the connector is male. The communications interface module, a daughtercard that sits immediately behind the connector, contains communications interface requirements for RS-232, RS-422, or V.35

connections. Supporting four ports requires two of these modules.

The LAN²LAN/Mega Router, like the Microcom LAN Bridge 6000 and Novell's NetWare Link/T1, supports line speeds of 1.544 megabits per second, the throughput rate of a typical T1 link in the United States. In Europe, however, line speeds up to 2.048 megabits are common; accordingly, all three of these products can accommodate that speed. An 85C30 10-MHz enhanced serial communications controller (SCC), not shown here, can support a full duplex communications line at that speed; the product can have one or two SCCs. Alternatively, the product can support four fractional T1 circuits in full duplex mode.

The SCCs are hidden beneath an optional daughterboard that contains a second processor, a 20-MHz 80286 used solely for data compression. This feature makes Newport's model stand out from most of the competition. The only

other product to include on-board hardware compression is the Microcom LAN Bridge 6000, which provides a second Motorola 68000 to handle compression duties. While the Microcom stops compressing data at 64 Kbps, the LAN²LAN/Mega Router compresses data at speeds up to 128 Kbps. The data compression module, at the upper right of the board, also houses a 40-MHz clock and 128K of SRAM rated at 70 nanoseconds. When the data compression daughterboard is installed, the communications adapter supports only two ports.



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CONNECTIVITY

BRIDGES AND ROUTERS

choice of modem, multiplexer, or PAD. You install its WNIC card in an AT or better computer. Its X.25 software allows users and equipment on one network to establish up to 64 simultaneous sessions with other LANs by way of the PDN.

The WNIC card contains a 10-MHz NEC V50 processor and 512K of RAM, giving it the processing power to handle a large quantity of packets. Although Eicon and Gateway provide 1MB of RAM with their cards, our benchmark tests show that the Newport router's 512K is adequate for the job. The WNIC card's versatile connection options let you configure it as any of four types of ports for use with various WAN termination hardware: RS-232, RS-422, V.35, or X.21.

DYNAMICALLY LEARNS COMPRESSION

The WNIC's maximum data rate is specified at 640 to 2,315 packets per second, depending on the packet size, or 2.048 megabits per second. Newport's proprie-

tary compression algorithm, used in its LAN²LAN software, is a dynamic learning algorithm. The dynamic learning algorithm learns data patterns as they are processed for transmission, providing better compression for subsequent patterns and dynamically adjusting and reacting as the data type changes. The LAN²LAN/Mega Router compresses data at speeds up to 128 Kbps, reducing the cost of PDN service.

To be effective at 128 Kbps, the WNIC includes a 16-MHz 80286 processor on a daughtercard used solely for compression. Some other companies that sell cards with only one processor, such as Eicon, stop compressing after speeds of 64 Kbps because the overhead of compression slows down the throughput. The extra processing power of the Newport system keeps it economical at higher speeds. On the Noncompressible File Throughput test,

its scores fell in the midrange. But on the Compressible File Throughput test, LAN²LAN had one of the best scores we saw, trailing behind only the Microcom LAN Bridge 6000.

You can use either *NetWare's* BRGEN or ROUTEGEN programs when installing the LAN²LAN/Mega Router. If you use *NetWare* 3.0 or later, you can install the router and software as an NLM in the server in only five minutes. Just type "LOAD LAN2LAN" and "BIND IPX TO LAN2LAN" to get the software up and running. Without resorting to BRGEN or ROUTEGEN, you can then configure the destination addresses, router names, and port configurations through simple menus.

Installing the hardware is less complicated. In most situations, you can keep the default settings, but if you have to change the I/O address or IRQ setting, the documentation tells you how. The whole process takes about an hour.

BRIDGES AND ROUTERS: SUMMARY OF FEATURES

Products listed in ascending price order

	Eicon Router for NetWare	POWERbridge	Novell Link/X.25	G/X25 Gateway & Bridge 64	Microcom LAN Bridge 6500
List price (tested version)	\$2,090	\$2,340	\$3,395	\$3,495	\$3,999
GENERAL FEATURES					
Type of network interface device	Router	NetBIOS router	Router	Router/X.25 gateway	Bridge
Works without Novell's BRGEN/ROUTE GEN	☐	☒	☐	☐	☒
Processor on communications adapter	16-MHz 68000	16-MHz 68000	16-MHz 68000	10-MHz 80186	16-MHz 68000
On-board RAM	1MB	1MB	1MB	512K	576K
Data compression	Up to 64 Kbps	Up to 64 Kbps	Up to 64 Kbps	Up to 64 Kbps	Up to 64 Kbps
On-board processor for data compression	☐	☐	☐	☐	☐
PROTOCOLS SUPPORTED					
IPX	☒	☐	☒	☒	☒
NetBIOS	☐	☒	☐	☒	☒
IP	☐	☐	☐	☐	☒
OSI	☐	☐	☐	☐	☒
XNS	☐	☐	☐	☒	☒
LINKS SUPPORTED					
Frame relay	☒	☐	☐	☐	☐
Switched 56	☒	☐	☐	☒	☒
ISDN	☐	☐	☐	☐	☒
T1	☐	☐	☐	☐	☐
Fractional T1	☒	☐	☐	☒	☒
X.25	☒	☒	☒	☒	☒
Number of virtual circuits supported through the PDN	254	254	12	16	15
Maximum connection rate	384 Kbps	384 Kbps	64 Kbps	64 Kbps	64 Kbps
Maximum number of packets per second	200	200	35	60	500
NETWORK SUPPORT					
Network operating systems supported	NetWare	Any NetBIOS	NetWare	NetWare	Any network
LAN adapter included	☐	☐	☐	☐	☒ (Ethernet)

 —Editors' Choice

☒ —Yes

☐ —No

N/A—Not applicable: The product does not have this feature.

CONNECTIVITY

BRIDGES AND ROUTERS

NETWORK SURVEYOR STATISTICS

Once you get it working, LAN²LAN/Mega Router operates transparently. It includes a program called *Surveyor* that lets you monitor, troubleshoot, and display statistical information from anywhere on the network. Novices and experienced users will feel comfortable with *Surveyor*'s interface, which is driven by menus and function keys.

As with the Eicon and Gateway units, the LAN²LAN/Mega Router's statistics screens show the router's current status and display useful error messages to help you diagnose internetwork problems. You can view information such as packets sent and received, connection type and time, and response time from any computer on the network. As a true IPX dynamic router, it routes IPX packets through the internetwork link to other LANs. Also like the Eicon and Gateway products, the LAN²LAN/Mega Router reduces extra traffic and cost by learning the home

segment of the stations on the networks and routing packets according to the locations it remembers.

Newport Systems Solutions offers support at a toll-free number from 8:00 to 5:00 P.S.T., but says that your dealer should be the first source you turn to for support. Newport's flexible connection options for the LAN²LAN/Mega Router provide a complete solution for LAN-to-LAN connectivity. You can start slow and grow to T1 speeds without changing adapters, just by using the software for the HDLC protocol rather than X.25. With its support for HDLC, the LAN²LAN/Mega Router is best suited to point-to-point connections, particularly if your organization expects good response time when transferring a heavy amount of data and using resources in another city.

NOVELL INC.

NetWare Link/X.25 NetWare Link/T1

Novell markets two completely different solutions for LAN-to-LAN connectivity. NetWare Link/X.25 is an OEM version of the Eicon Router for NetWare, while NetWare Link/T1 is an OEM version of Newport Systems Solutions' LAN²LAN/Mega Router. These products work over many types of connections, including Switched 56, X.25, and fractional T1. At \$3,395, the NetWare Link/X.25 provides a cost-effective solution for PDN connectivity with software support for the X.25 protocol. The \$5,490 NetWare Link/T1 provides support for the HDLC signaling protocol at speeds of up to 1.544 megabits per second and beyond for point-to-point communications. As you might expect, the Novell offerings work only on *NetWare* LANs.

The Novell Extended Adapter and software that make up the NetWare Link/X.25 package are available separately for \$1,645 and \$1,750, respectively. The Novell Synchronous/Plus Adapter and software that form the Link/T1 package can also be purchased separately, for \$1,495 and \$3,995, respectively. The company also offers the \$2,990 Link/64, which we do not review here. This is also an OEM version of the Newport product, but one that uses artificial controls to limit its HDLC protocol support to 64 Kbps.

The Novell Link/X.25 and Link/T1 offerings and their Eicon and Newport counterparts have a few differences, including price, but Novell's products are still of interest because of the number of *NetWare* users who want to know what is available from the company itself. We will focus on the differences here. For more information, see the Eicon and Newport reviews.

STANDARD NETWARE INTERFACE

The Link/X.25 and the Eicon Router for NetWare differ in four ways. First, Novell wrote its own configuration program to set the options for the router. This program, which uses the standard *NetWare* interface and its C-Worthy tools, is simple enough to use. Second, Novell uses an older version of the router software, limited to 12 virtual circuits. Third, Novell does not provide support for the frame relay protocol. Finally, Link/X.25 employs a less capable communications card, limited to 35 packets per second. Although the numbers for both the Compressible File Throughput and Noncompressible File Throughput tests place the Link/X.25 at the bottom of the pack, it should handle the X.25 needs of an average-size installation.

The Link/X.25 hardware/software

Microcom LAN Bridge 6000	Novell Link/T1	LAN ² LAN/Mega Router
\$4,499	\$5,490	\$6,790
Bridge	Router	Router
16-MHz 68000 376K	10-MHz V50 512K	10-MHz V50 512K
Up to 64 Kbps (16-MHz 68000)	Up to 64 Kbps	Up to 128 Kbps (20-MHz 80286)
	■	■
	□	□
	□	□
	□	□
	□	□
	□	□
	□	□
5.048 Mbps .000	N/A 2.048 Mbps 813	64 2.048 Mbps 2,315
any network (Ethernet)	NetWare □	NetWare □



FACT FILE

NetWare Link/X.25
NetWare Link/T1
Novell Inc., 122 East 1700 South, Provo, UT 84606; 800-638-9273, 801-429-7000.
List Price: Link/X.25, \$3,395; Link/T1, \$5,490.
Requires: 286-based PC or better, 384K RAM, connection to other LAN, *NetWare* 2.15c or later, DOS 3.0 or later.
In 15c: Novell offers solutions for many types of connections, along with the support and stability of a large company. Link/X.25, an OEM version of the Eicon Router for NetWare, uses compression to reduce costs and enhance PDN throughput. Link/T1, an OEM version of Newport's LAN²LAN/Mega Router, blasts data across point-to-point links.

CIRCLE 608 ON READER SERVICE CARD

Some days you have
all the time in the world.



When the pressure is on, pour on the speed. With Hewlett-Packard's new LaserJet IIISi printer. A powerhouse that delivers at a throughput speed of 17 pages per minute.

With the LaserJet IIISi, you're up to speed the moment you give the "print" command. HP's RISC-based formatter and the PCL5 printer language, with vector graphics and on-the-fly typeface scaling, yield fast

results. This printer also represents a new standard for I/O performance with optional Network Printer Interface cards for either Ethernet or Token Ring.

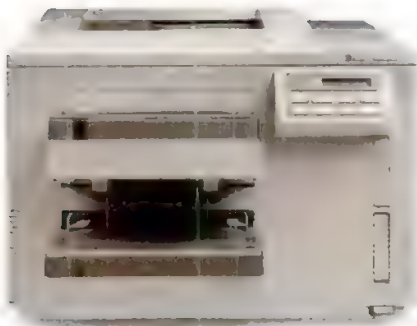
The LaserJet IIISi is specifically designed for shared-use environments. Its high-volume paper handling features include two 500-sheet input trays and a monthly duty cycle of 50,000 pages. HP offers software-selectable language switching

between PCL5 and optional Adobe® PostScript®. For added versatility, your options include

Adobe and PostScript are registered trademarks of Adobe Systems Inc. in the U.S. and other countries.



And some days you need the new 17ppm LaserJet IIISi.



an envelope feeder and two-sided printing.

Beyond speed and efficiency, the LaserJet IIISi delivers the sharpest 300 dpi print quality yet. In fact, HP's revolutionary combination of Resolution Enhancement technology and new microfine toner challenges the print quality of many 600 dpi printers.

The price of the new LaserJet IIISi, just \$5495*, is as impressive

as the work load it handles. If you're ready to pick up the pace, call **1-800-752-0900, Ext. 2067** for more information on the fastest LaserJet printer and the name of your nearest authorized HP dealer.

HP Peripherals
When it's important to you.



**HEWLETT
PACKARD**

CIRCLE 218 ON READER SERVICE CARD



PERFORMANCE TESTS: BRIDGES AND ROUTERS

Hardware data compression costs money up front, but it can save big bucks on monthly communications bills. Our tests show that if you use transport media rated at 64 or even 128 kilobits per second, hardware data compression can help you squeeze the last dollars of value out of expensive communications links.

WHAT THE NUMBERS MEAN

The products in this review used different communications schemes across the internetwork link. For example, the majority of routers we review here are IPX dynamic routers; Performance Technology's POWERbridge, on the other hand, is a NetBIOS router. Microcom Systems' LAN Bridges are not routers at all but true MAC-layer bridges. They deal with longer packets, containing more information, and therefore must send more data across the internetwork link to get the job done.

While the differences in architecture among the products mean that you should weigh comparisons carefully, one conclusion is clear from these tests. Though you pay for extra processing power, you get results in terms of throughput. When long-distance circuits can cost several thousand dollars a month, investing in bridges or routers that have communications adapters with on-board

processors for data compression makes sense.

The Microcom LAN Bridge 6000 and Newport Systems Solutions' LAN²LAN/Mega Router have two of the highest price tags among the products we tested. But for its price, the LAN²LAN/Mega Router includes a communications adapter with a separate 80286 processor dedicated to compressing data for transmission. And the Microcom LAN Bridge 6000 comes with two processors of the Motorola 68000 family and two custom integrated circuits to handle compression and communications. The availability of data compression at the hardware level helped these products achieve the fastest throughput scores we saw.

The Eicon Router for NetWare does not include data compression at the hardware level, so no one was surprised that this router, along with most of the competition, could not live

up to the throughput records set by the Microcom LAN Bridge 6000 and LAN²LAN/Mega Router. Interestingly, the Eicon Router provides support not only for the X.25 protocol but also for the faster and newer frame relay protocol, which lowers overhead and reduces the network workload. Yet in our relatively simple tests across a single piece of cable, we saw no significant throughput advantage when operating the Eicon using the frame relay protocol instead of the X.25 protocol. Under real-world conditions, you would probably see a greater increase in throughput.

Performance Technology's POWERbridge did not fare particularly well against the competition on these tests. Its lower performance results may be due partly to the fact that we had to test it under a different network operating system.

HOW WE TESTED

The LAN test-bed consisted of two LAN segments. On each LAN segment we set up a Dell 220 PC with a 286/12 processor, 2MB RAM, and a Western Digital 8013EBT Ethernet LAN adapter; this computer acted as the bridge or router. On the first LAN segment we set up an ALR Flexnode PC using a 386/20 processor, 4K of RAM, and a Western Digital 8013EBT Ethernet LAN adapter as the client workstation. The second LAN segment included a 486/33 ALR Powercache PC with 8MB of RAM and a Western Digital 8013EBT Ethernet LAN adapter; this was configured as a NetWare 3.11 server. We used null-modem cables to connect the tested bridges and routers to each other.

For Performance Technology's POWERbridge NetBIOS router, we used the same 386-based server but ran Performance Technology's own POWERlan networking software because we

needed NetBIOS packets.

The results of these NetBIOS-based tests are only roughly comparable to those of the IPX-based systems. While the computers running the tests are the same, the underlying communications protocols and operating systems are very different. Yet because the signaling speed of the internetwork link is so much slower than that of a network cable, some of the differences should have been minimized enough to allow reasonable comparison, at least on the system level.

To measure the throughput of these products, we transferred both compressible and noncompressible files at 56 kilobits per second, a speed at which data compression is still available. We also transferred noncompressible files at 1.544 megabits per second; we report these results only for the three products in our review that operate at this speed. We did not test compressible files at 1.544 Mbps because

most of these products do not perform data compression beyond 64 Kbps; only one, Newport Systems Solutions' LAN²LAN/Mega Router, performs compression up to 128 Kbps.

We ran both the Compressible and Noncompressible File Throughput tests three times each. We used the DOS copy command, measured the elapsed times using the CPU system clock, averaged the results, and converted the averaged time to throughput in kilobits per second.

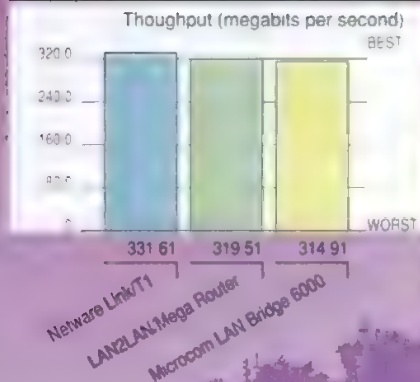
For the **Noncompressible File Throughput** tests, a 3MB file that had already been compressed was transferred between the file server on one segment and the client PC on the other via the bridge or router.

For the **Compressible File Throughput** test, a 3MB file was transferred between the file server on one segment and the client PC on the other via the bridge or router, using the bridge or router's data compression features.

CONNECTIVITY

BRIDGES AND ROUTERS

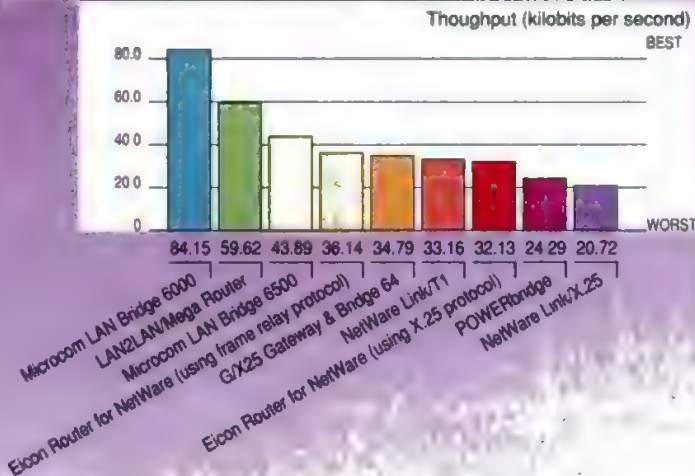
Noncompressible File Throughput (1.544 Mbps)



Noncompressible File Throughput (1.544 Mbps) Throughput (megabits per second)

Netware Link/T1	331.61
LAN2LAN/Mega Router	319.51
Microcom LAN Bridge 6000	314.91

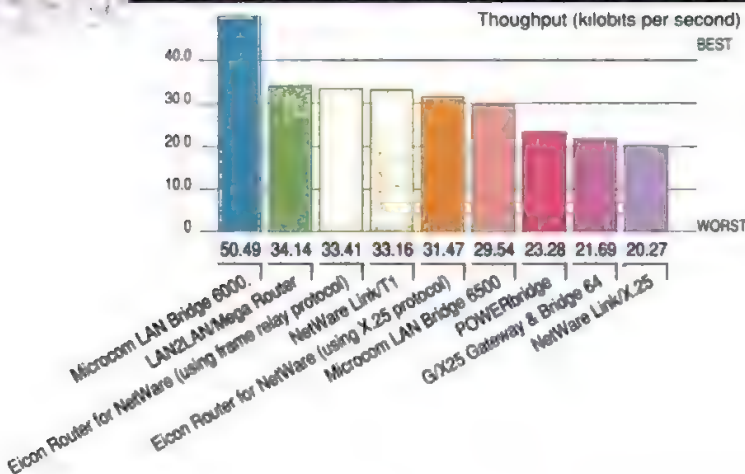
Compressible File Throughput (56 Kbps)



Compressible File Throughput (56 Kbps) Throughput (kilobits per second)

Microcom LAN Bridge 6000	84.15
LAN2LAN/Mega Router	59.62
Microcom LAN Bridge 6500	43.89
Eicon Router for NetWare (using frame relay protocol)	36.14
G/X25 Gateway & Bridge 64	34.79
NetWare Link/T1	33.16
Eicon Router for NetWare (using X.25 protocol)	32.13
POWERbridge	24.29
NetWare Link/X.25	20.72

Noncompressible File Throughput (56 Kbps)



Noncompressible File Throughput (56 Kbps) Throughput (kilobits per second)

Microcom LAN Bridge 6000	50.49
LAN2LAN/Mega Router	34.14
Eicon Router for NetWare (using frame relay protocol)	33.41
NetWare Link/T1	33.16
Eicon Router for NetWare (using X.25 protocol)	31.47
Microcom LAN Bridge 6500	29.54
POWERbridge	23.28
G/X25 Gateway & Bridge 64	21.69
NetWare Link/X.25	20.27

BENCHMARK TESTS: BRIDGES AND ROUTERS



Bridges and routers need to keep up with the general activity that can be generated by many users accessing the internetwork link. Our benchmark tests show that even when there is more than one PC transferring files across the links, bridges and routers generally have little degradation in performance.

WHAT THE NUMBERS MEAN

The Workstation Throughput Evaluation test reflects the typical experience of 15 users running application programs simultaneously over the internetwork link.

At 56 Kbps, the Microcom LAN Bridge 6000 and Newport's LAN²LAN/Mega Router took the lead, which can be attributed to the additional on-board processor for handling data compression on these two products. The other products had average throughput scores, with the exception of Performance Technology's POWERbridge and Novell's NetWare Link/X.25, which yielded below-average scores. Interestingly, the results achieved on these benchmark tests were in line with the results obtained on the Compressible and Noncompressible File Throughput

performance tests (which transferred only a single file across the link) when we ran them at this speed.

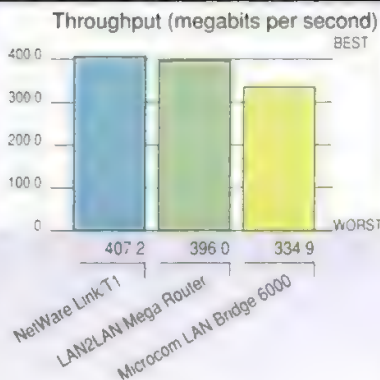
Only three products—the NetWare Link/T1, the LAN²LAN, and the Microcom 6000—operate at 1.544 Mbps or faster. At speeds above 64 Kbps on the Microcom 6000 and 128 Kbps on the LAN²LAN, on-board data compression is no longer effective. At 1.544 Mbps, these two products were unable to maintain their lead over the NetWare product, as was also the case on the Noncompressible File Throughput test. They trailed behind the NetWare Link/T1, which is actually an OEM version of Newport's LAN²LAN board without the hardware-based data compression.

HOW WE TESTED

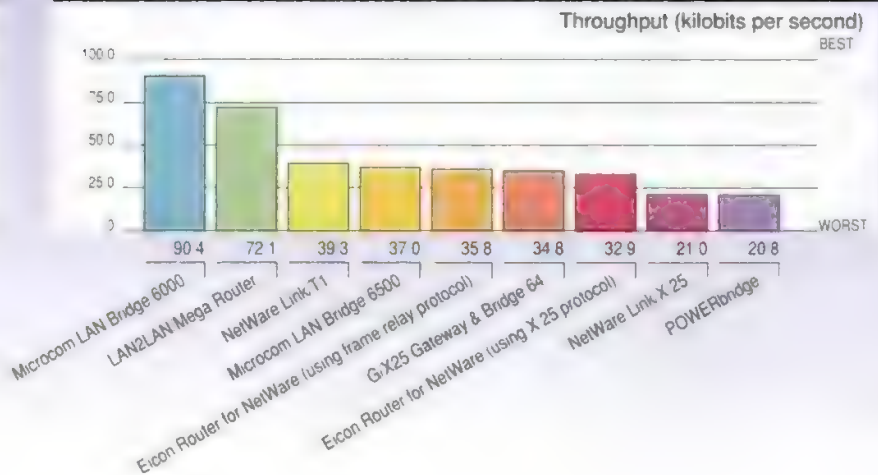
The LAN test-bed consisted of two LAN segments. On each LAN segment we set up a Dell 220 PC with a 286/12 processor, 2MB RAM, and a Western Digital 8013EBT Ethernet LAN adapter as the computer acting as the bridge or router. On the first LAN segment we set up an ALR Flexnode PC using a 386/20 processor, 4K of RAM, and a Western Digital 8013EBT Ethernet LAN adapter as the client workstation. The second LAN segment included a 486/33 ALR Powercache PC with 8MB of RAM and a Western Digital 8013EBT Ethernet LAN adapter configured as a NetWare 3.11 server. We used null-modem cables to connect the tested bridges or routers to each other.

For Performance Technology's POWERbridge NetBIOS router, we used the same 386-based server but ran Performance Technology's own PowerLAN network software because we needed NetBIOS packets.

Workstation Throughput Evaluation (1.544 Mbps)



Workstation Throughput Evaluation (56 Kbps)



CONNECTIVITY BRIDGES AND ROUTERS

We ran the Workstation Throughput Evaluation test on the client PC at speeds of both 56 Kbps and 1.544 Mbps. We report the latter results only for the three systems in the review that operate at this speed.

PC Magazine LAN Labs' benchmark tests are written in C and are independent of commercial software. Each load station operates at a rate many times that of a PC in even a heavy-use environment.

The **Workstation Throughput Evaluation** test reports the throughput recorded during the performance of a standardized task on the network. The test program performs a sequential read, a random read, a sequential write, and a random write using a 1MB file. The record size systematically rotates among 16K, 4K, and 512 bytes. Because of the slow internetwork links, we report the throughput in kilobits per second instead of the usual megabits per second.

Workstation Throughput Evaluation (1.544 Mbps) Throughput (megabits per second)

NetWare Link/T1	407.20
LAN²LAN/Mega Router	396.00
Microcom LAN Bridge 6000	334.90

Workstation Throughput Evaluation (56 Kbps) Throughput (kilobits per second)

Microcom LAN Bridge 6000	90.40
LAN²LAN/Mega Router	72.10
NetWare Link/T1	39.30
Microcom LAN Bridge 6500	37.00
Eicon Router for NetWare (using frame relay protocol)	35.80
G/X25 Gateway & Bridge 64 (using X.25 protocol)	34.80
Eicon Router for NetWare	32.90
NetWare Link/X.25	21.00
POWERbridge	20.80

combination includes an Eicon/PC WAN card that installs in a 286, 386, or 486 computer, along with a cable for connecting to a modem. Since the X.25 software supports as many as 12 virtual circuits through the PDN, network users can establish up to 12 simultaneous sessions across the link.

COMPETING AGAINST NEWPORT

You will find even fewer differences between the Link/T1 product and its Newport cousin. One minor difference is that the menus display Novell's name in place of Newport's. Unlike the Newport model, Link/T1 does not include software sup-

Novell's Link/T1
furnishes a very
worthwhile point-to-
point solution.

port for the X.25 protocol. Novell chose not to offer the compression daughterboard as an option for its NetWare Link products. The company believes that nobody will buy a product that supports only the HDLC protocol to run at slower speeds and that at higher speeds, data compression is simply not effective. At 1.544 mbps on our Noncompressible File Throughput test, the Novell product provides slightly faster throughput than the Newport router, which takes the lead on our Compressible File Throughput test at 56 Kbps. At slower speeds on the non-compressible test, the Newport has a slight lead over Novell's product.

Support for either Novell product is available through Novell's network of resellers or directly via a toll-free line from 8:00 to 5:00 P.S.T. The company's NetWare Link products supply flexible speed and connection options to suit the LAN-to-LAN routing needs of many types of installations. In particular, the Link/X.25 is a good solution for companies wanting to use the PDN to connect geographically diverse offices, while the Link/T1 furnishes a very worthwhile point-to-point solution.

PERFORMANCE TECHNOLOGY

POWERbridge

Performance Technology's POWERbridge is not a bridge; we classify it as a NetBIOS router. Performance Technology markets this solution for both X.25 and V.32 (9600 bps) point-to-point dial modem connections. It works on all types of NetBIOS LANs, from *LAN Manager* to *LANtastic*, but does not support *NetWare*. Performance Technology bundles its *POWERbridge* software with Eicon's HSI card to provide a complete LAN-to-LAN package. At \$2,340, the *POWERbridge* package offers a good option for many organizations that require products with software support for the X.25 protocol. You can purchase the *POWERbridge* software separately for \$995.

Bridges operate at the MAC layer of the OSI protocol stack. *POWERbridge*, on the other hand, works at the network layer of the OSI stack and routes NetBIOS packets to their destination, just as other routers in this review move IPX packets. *POWERbridge*, a true NetBIOS dynamic router, learns the home segments of stations on the networks in real time and properly routes packets, saving money and boosting throughput. Although it routes only NetBIOS packets, it also works on *NetWare* LANs that run NetBIOS. But



POWERbridge

Performance Technology, 7800 IH 10, W. 800 Lincoln Center, San Antonio, TX 78230; 800-825-5267, 512-349-2000.

List Price: \$2,340.

Requires: 286-based PC or better, 70K to 110K RAM, NetBIOS LAN, connection to other NetBIOS LAN, DOS 3.1 or later.

In Short: A good NetBIOS router from a company with an excellent reputation in the connectivity market, *POWERbridge* could make operation easier with a menu-driven interface. Performance Technology would also benefit by broadening the product's connection options.

CIRCLE 608 ON READER SERVICE CARD

INTRODUCING THE EVER HAPPENED



BEST THING THAT TO WINDOWS.

THE NORTON DESKTOP[™] FOR WINDOWS[™]

Now you can make Windows perform the way you've always wanted—without changing the way you use it. For just \$149*, The Norton Desktop includes an impressive collection of Peter Norton's best programs that make Windows more accessible and a whole lot easier to use.

For starters, you can move your programs and file groups from the confinement of the Windows Program Manager to the freedom of The Norton Desktop—it's like having your file manager and program manager transparently integrated!

The Norton Desktop's enhanced file manager allows you to launch, copy, move, view and delete a

file or application by clicking and dragging icons on the desktop. You can also print documents by dragging files to any printer icon. In fact, our icon editor makes it easy to select any of the more than 150 icons provided, while The Norton Viewer enables you to instantly

view files from over 30 Windows and DOS applications.

Not only does The Norton Desktop make sure that your files are well managed, it also ensures they're well protected.

We've included The Norton Backup[™]

for Windows,** the fastest, most reliable Windows backup you can buy. You can easily set-up automatic backups for any time of the day or night, whether you're present or not, and backup in the background, even to and from network drives.

The Norton Desktop also provides the easiest UnErase[™] ever, for stand-alone PCs and network systems, plus the industry's most powerful automatic disk diagnosis/repair.

The program has a host of additional features, including a rich assortment of colorful screen savers, along with our SuperFind[™] text searching, which enables you to search and find files quickly and easily on any disk drive—even on networks.

So if you're ready to improve your Windows, call 1-800-343-4714, Ext. 722P for more information about The Norton Desktop. Or visit your nearest dealer and pick up a copy for yourself. It could be the best thing that ever happened to your PC.

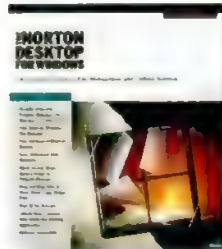
UnErase



The Norton Desktop integrates a file manager and program manager into one seamless desktop.



Norton Backup



SYMANTEC.

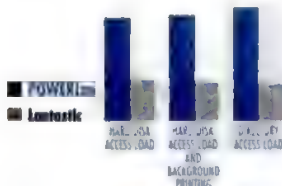
GREAT PERFORMANCE GETS YOUR ATTENTION GREAT TECHNOLOGY KEEPS IT

DOS Networking

"POWERLan swept all of the performance categories on our benchmark tests."

"If you need to link DOS, OS/2, Unix, and other platforms in an interoperable network ... POWERLan is the product to choose"

"you can't ignore this powerhouse, POWERLan's features speak for themselves; its speed convinces"



June 25 1991
POWERLan Version 2.10

POWERsave

Network Backup

"This is the fastest single-file restore we found in any of the systems, including server-based units. We didn't believe it either until we ran the test three times."

"simple to use"

"Performance Technology may have the fastest workstation-based drive in Netwaredom."

"offers excellent progress tracking"

"operates ... at warp speed"

LAN Times, June 17, 1991



Sure, we like to make products that go fast. But, performance is just one quality we take seriously. Operating in multi-vendor environments is high on our list too. And there's lots more. Call us to get the rest of the story.

POWERfusion

DOS - UNIX Connection

"In our benchmark tests, Performance Technology lived up to its name."

"... the POWERfusion family can support large networks of busy users and still deliver"

"If you're looking for a way to connect your Unix box to a network of DOS-based PCs, look no further."



May 28 1991
POWERfusion, Version 1.3

"Performance Technology is selling glue technology that can help solve a variety of local and wide-area networking problems. Lord knows, that's something we all need."

BYTE, March 1991

POWERbridge

LAN to LAN Connection

"Usually I wonder about a product that has 'power' associated with it, but POWERbridge ... deserves the honor."

"POWERbridge supports nine operating systems ... links all the networks you'll ever have."

LAN Times, February 4, 1991

"... well, you haven't lived until ... (you) ... hop through a NetWare LAN to an SMB server running under Unix" (with POWERbridge)

BYTE, March 1991

Networld Booth 1564

CIRCLE 195 ON READER SERVICE CARD
**PERFORMANCE
TECHNOLOGY**

**800-FAST-LAN
800-PC-2-UNIX
512-349-2000**



CONNECTIVITY BRIDGES AND ROUTERS

it recognizes only the NetBIOS packets generated there and only a few programs, primarily 3270 SNA gateways, use NetBIOS on *NetWare*.

For speeds up to and including 64 Kbps, *POWERbridge* uses a compression algorithm to supply greater throughput. The compression routine works on the fly to reduce the amount of data that goes across the internetwork link. Through multiple virtual circuits, users can establish as many as 254 simultaneous sessions with other networks over the PDN.

The bundled Eicon HSI card, powered by a 16-MHz Motorola 68000, includes 1MB of RAM. You can configure the board to communicate according to RS-232, V.35, or X.21 signaling and cabling standards. Although the board includes these connection standards, the instruction manual does not explain how to at-

.....

The *POWERbridge*
product is a true
NetBIOS dynamic
router.

.....

tach *POWERbridge* to something other than a modem.

The HSI card installs in a 286-based PC or better and connects to a modem or other circuit termination equipment via a separately priced cable; the type of cable you buy depends on the connection you need to make.

NONDEDICATED OPERATION

You can use a dedicated or nondedicated computer on the network for *POWERbridge*, but whether you can run other applications on the same computer depends on the amount of network traffic crossing the router, the type of application, and the power and configuration of the computer. As with the Eicon Router for *NetWare*, the hardware installation is simple. The HSI card's default settings should be correct for most computers, but the documentation provides easily understandable instructions if you need to change the IRQ setting or I/O address.

Software installation and operation would be somewhat easier if the installa-

tion program automatically configured your boot disk to come up as the router, but it does not. Fortunately, the documentation provides clear instructions on how to accomplish this.

COMMAND LINE OPERATION

Once operational, *POWERbridge* routes packets transparently. Performance Technology's *BRIDGE.EXE*, not to be confused with Novell's *BRGEN*, uses dozens of command line options for everything from providing security to dialing remote LANs. System administrators will have to run this program with the instruction manual in their laps.

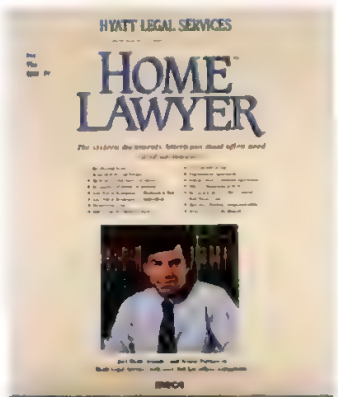
If you are an administrator, you can run a control program from your own PC to monitor traffic, rename resources, and establish new connections. The monitor screen displays many useful pieces of data, including the number of current connections, amount of traffic for various periods, and bad packet information. With the proper privileges, you can access this information from any computer on the network.

In our tests, *POWERbridge* provided slower throughput than some of its competitors. The maximum data throughput rate of the Eicon HSI card in the *POWERbridge* router totals 200 packets per second, or 384 Kbps. On the Compressible File Throughput test it achieved a score in a lower tier, 24.29 Kbps at 56 Kbps. The pattern repeated itself in the Noncompressible File Throughput test. Keep in mind that we ran the product under a completely different LAN operating system than *NetWare*, Performance Technology's own *POWERlan*, because we needed NetBIOS packets. The test results cannot be directly compared with the IPX routers; they not only show differences in the router software but reflect design differences between NetBIOS and IPX.

Performance Technology offers multiple support options if dealer support is not satisfactory. Support contracts are available for \$250 per hour of phone support with unlimited BBS support. The company also provides support via a 900 number for \$2.50 per minute from 8:00 to 5:00 C.S.T.

Although it would most certainly benefit from a less cryptic, menu-driven user interface, *POWERbridge* makes a good choice for NetBIOS LAN-to-LAN connectivity. ■

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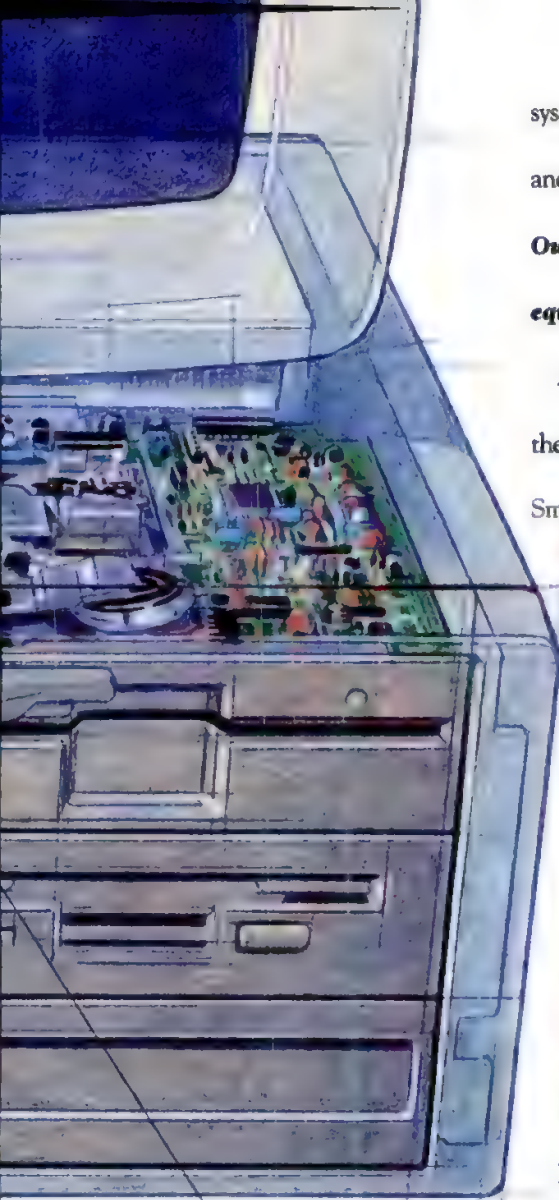
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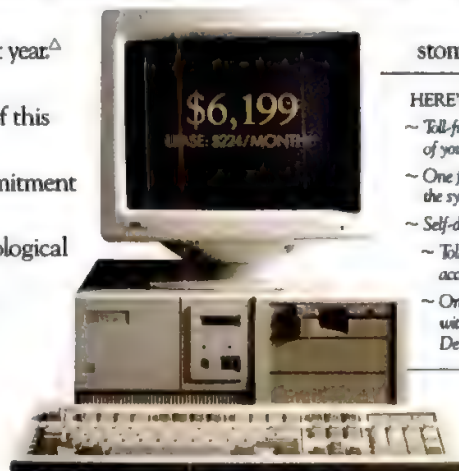
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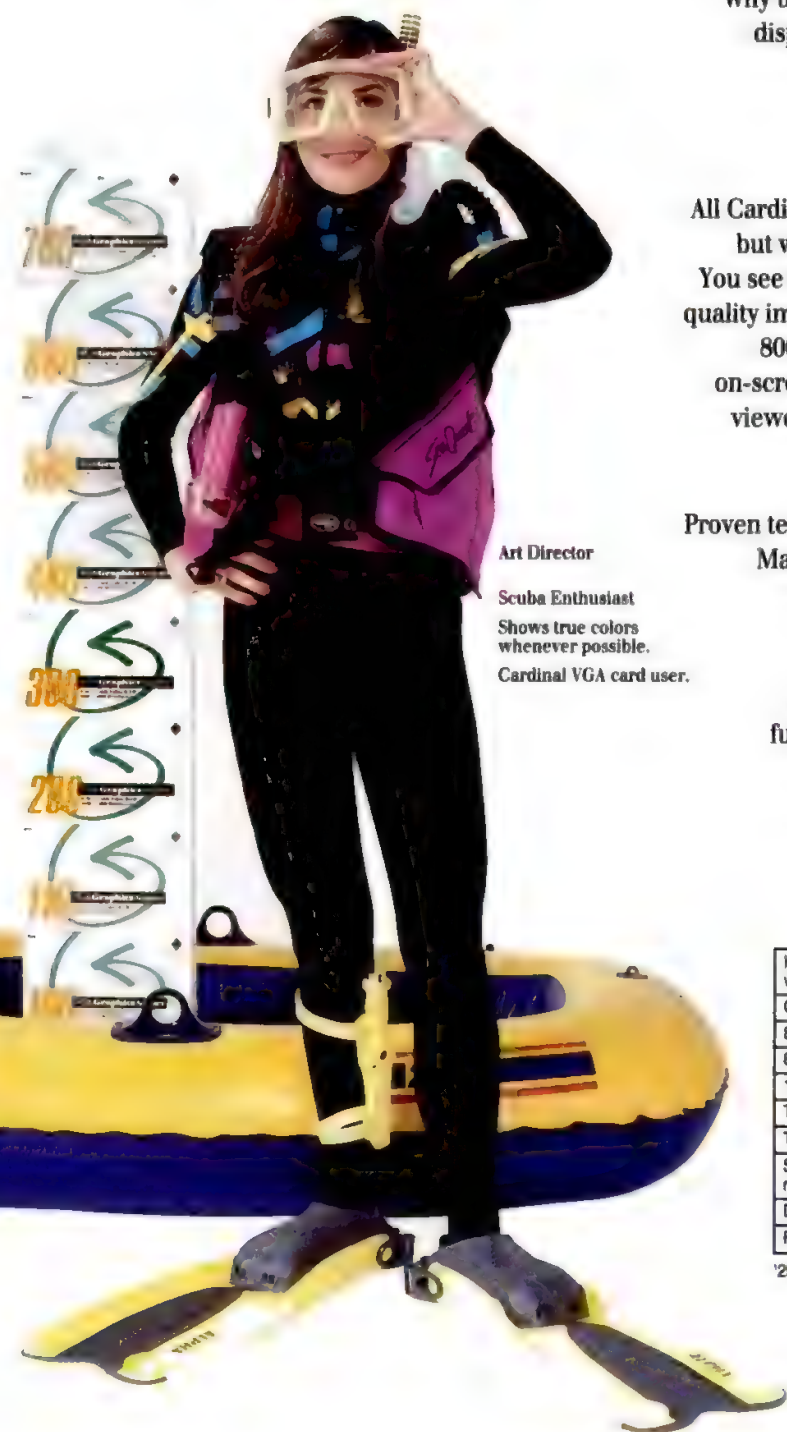
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ILLUSTRATION DON BAKER

ACCESS SERVERS

.
Access servers handle large numbers of callers at once—a boon to organizations with many off-site employees who need to use network resources. The seven products reviewed here also provide network access to users dialing in from modern servers on other LANs.

Dialing Up the LAN

BY M. KEITH THOMPSON AND STEVE RIGNEY Networks are for sharing. But users often need to share the resources of the network from wherever they might be, not just within an office with a LAN installation. Access servers give them a way to dial into the LAN from anywhere with a telephone line, circumventing the speed limitations normally imposed by those lines. Typically, users dialing into access servers use the public dial network.

Asynchronous access servers provide callers with remote access to the LAN resources to which they have

been assigned rights, whether the callers dial in from a standalone remote PC or through a modem server on another network. The access servers accomplish this gateway function with the aid of modem remote-control software. Each access server is connected to the LAN and can retrieve applications from a network server's hard disk to run on its own CPU cards; remote users can work on those programs. Calling into an access server, users can also check e-mail, transfer files, print on the LAN, or access a fax server to send faxes.

Asynchronous access servers are also ideal for client/server database applications, where the amount of information moved does not require installing a router or T1 line, generally costlier options. Although these products are designed for normal telephone lines, if you already have a T1 line or other dedicated link you can design solutions around either of those options for even better throughput.

Typically, vendors that sell access servers as complete turnkey solutions build them around either a husky card-cage cabinet containing multiple CPU cards with on-board serial ports or a multiport RS-232 board that you can install in almost any standard PC to take advantage of its own processor. Alloy Computer Products' PC-Slave/286 cards can work comfortably within their own moderately sized XBUS4/AT expansion chassis or in an ISA-bus PC; likewise, the CPU cards accompanying Cubix Corp.'s sturdily constructed ComBridge can fit in 286- or 386-based machines that have an adequate number of free slots.

TWO MEANS OF ACCESS

You can choose between two ways to access a network via a modem outside of the fat high-speed cable. In the first technique, known as *remote client*, the remote PC uses redirection software, just like a client PC on a LAN. The remote client PC treats the modem as a slow network interface adapter and routes all of the network activity through the serial port. This technique's only advantage is that it gives the remote PC a full set of redirected drives, allowing application programs to use their standard paths for program and data files. Its big disadvantage is slow response time. Pushing and pulling all of the small low-level messages designed for network communications across the slow modem link is an inefficient process.

The efficient method of network ac-

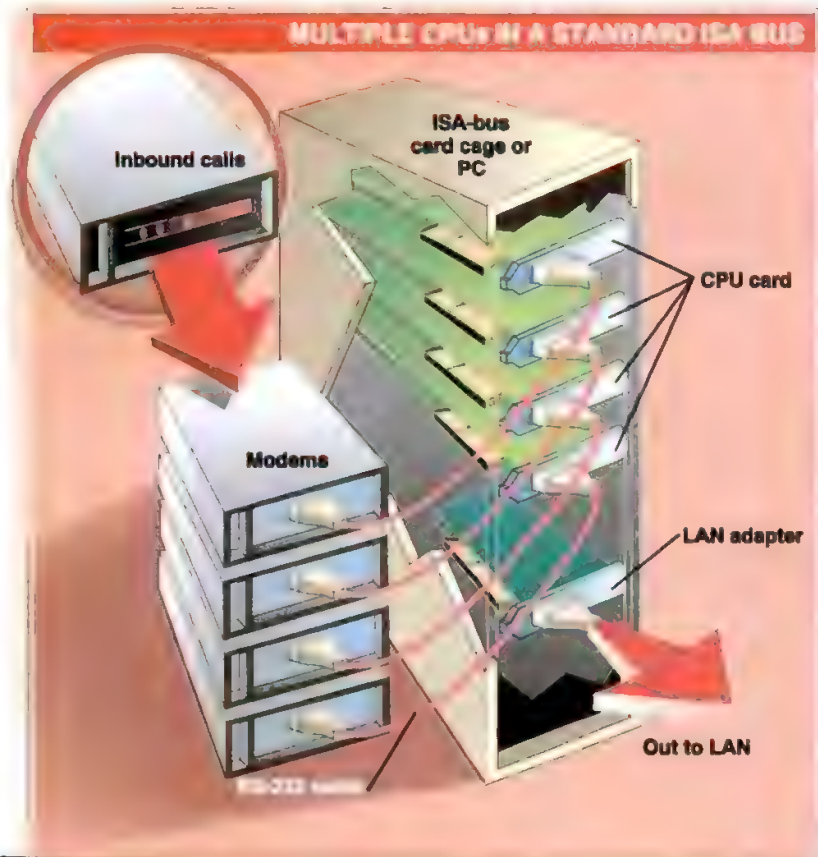
ACCESS SERVERS: THREE ARCHITECTURES FOR INBOUND (DIAL-IN) SERVICES

All products we reviewed provide multiport dial-in services. Remote users (or other access servers) can dial in, log onto the LAN, and access the resources to which they have rights. Access-server systems use three very different architectures to provide these services:

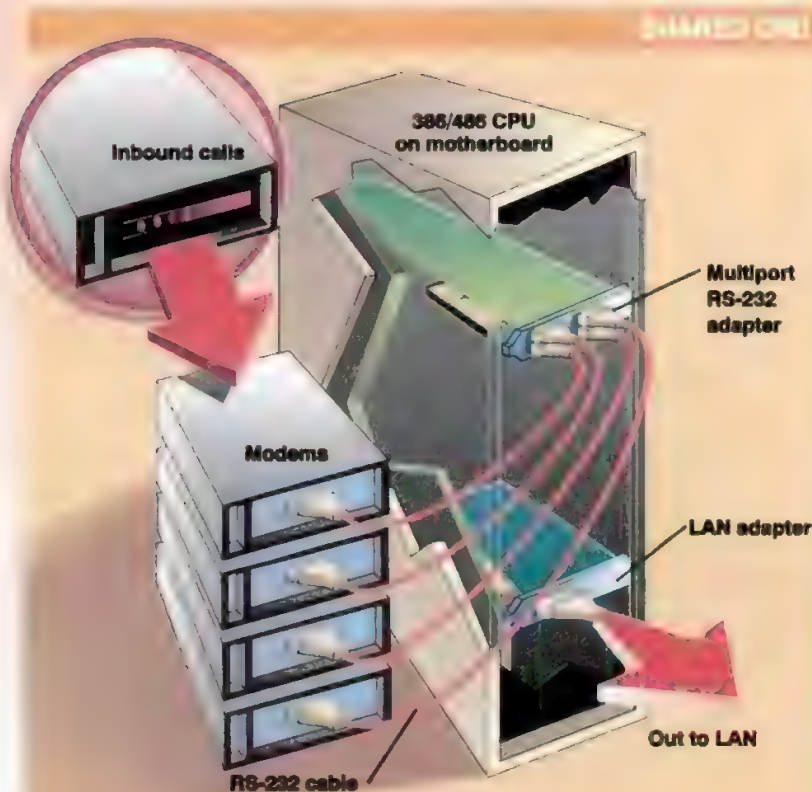
- The first, used by packages like Alloy Computer Products' PC-Slave/286 and XBUS4/AT, Cubix Corp.'s ComBridge, and Evergreen Systems' FlexCom, employs multiple CPUs in a standard ISA-bus card cage supplied by the vendor. (Most of these products also allow you to install their CPU cards in any standard ISA-bus PC with enough free slots.) Bridge software controls the actions of the CPUs and regulates their access to the single shared LAN adapter card.
- The second architecture, used exclusively by J&L Information Systems' Chatterbox 4000, places each CPU card in a slot cluster with a dedicated LAN adapter. The cards

share power and certain signal leads, but for most purposes each slot cluster is an island. This configuration does not require special software for bridging or multiplexing but does require a special card cage and a separate LAN adapter for each CPU card. A special hardware reset circuit can reboot each CPU when the attached modem drops its carrier-detect signal. This assures that a malfunctioning processor cannot lock out a CPU.

- The third, used by Alloy's 386/MultiWare, Novell's Access Server, and Vestra-Subco's LANMaster IncomServ shares the resources of a single 80386 or 80486 processor on the motherboard of a dedicated computer. A multitasking operating system divides the time of the processor while a multiport serial card provides links for modems. Special software multiplexes the IPX packets between the LAN adapter and the multiple sessions in the processor.



CONNECTIVITY ACCESS SERVERS



cess (and the one used by access servers) is called *modem remote control*. The concept of remotely controlling a networked PC through a modem is not new. Many users leave their office PCs running at night and continue working from home by controlling that PC through modem remote-control software (see "Modem Remote-Control Software: The Next Best Thing to Being There," June 12, 1990).

The remote PC needs only to run the remote-control software; there is no LAN redirector. In effect, the keyboards and screens of the remote and LAN-connected PCs operate in parallel, allowing keystrokes from the remote PC to control the LAN-connected machine and allowing the screen displays of the LAN-connected machine to appear on the screen of the remote PC. The application programs run on the LAN-connected PC, where they get full access to the high-speed network connections and resources.

This approach is susceptible to many human problems, however, such as forgetting to load the software before bolting out the door at 5 P.M. In addition, using personal PCs for remote control does not provide a standardized method of network access for people who normally work out of the office or in other offices.

Access servers avoid these problems because the remote-control software is always loaded on a system that is usually dedicated to this purpose. Rather than making you dial into the LAN and remotely control your networked office PC, access servers answer incoming calls and allow the caller to run networked applications from the answering CPU. That makes these products particularly useful for field workers or other out-of-office users who do not actually have a PC of their own at the office but need access to the network. Additionally, if an access server has a single remote program installed, it neatly avoids having to support a variety of different remote-control programs favored by various users.

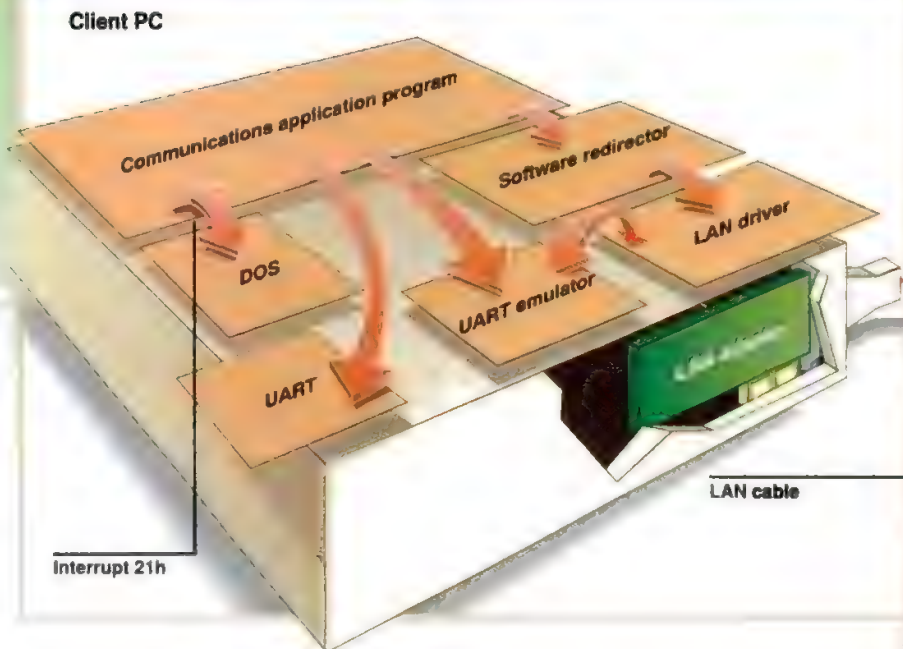
You can set up any spare PC equipped with modem remote-control software, a serial port, and a modem, and use it as an access server on a one-at-a-time, first-come-first-served basis. But it is more economical to set up a system like the ones we review here, which can service several callers at the same time. In modern networks, access servers can typically handle four or more simultaneous incoming sessions. With these products, each user dialing in has access to a CPU or

MODEM SERVERS: TWO APPROACHES FOR OUTBOUND (DIAL-OUT) SERVICES

Almost every product we review here can also act as a modem server. Modem servers make a group of modems available to client workstations for dialing out on a first-come-first-served basis. Users establish dedicated connections to modems in the pool via communications software that can communicate across a network. Even with the price of high-speed modems dropping, sharing modems among users still makes economic sense, since each business telephone line can cost as much as \$100 a month.

When application programs require disk access services from DOS, they send a request preceded by software interrupt 21h. When they communicate through a serial port, they typically address that port's UART hardware directly.

Communications applications can use a PC that acts as a modem server in one of two ways. First, a UART emulator in hardware can act as a communications port while moving the data to and from the network. Any communications program can work through this type of emulator. Second, the software can use a special software interrupt, typically 14h or 6bh, to establish an interface with a software redirector. Only a limited number of communications applications can generate the special software interrupt.



virtual CPU. Most of these devices can also act as *modem servers* or, as they are also called, *asynchronous communications servers*, which allow network users to share a modem for dialing out (see "Asynchronous Communications Servers," May 16, 1989).

REVIEW CRITERIA

In this review, PC Magazine LAN Labs evaluates seven asynchronous LAN access servers priced from \$1,995 to \$13,430: Alloy Computer Products' PC-Slave/286 and XBUS4/AT, Alloy's 386/MultiWare, Cubix's ComBridge, Evergreen Systems' FlexCom, J&L Information Systems' ChatterBox 4000, Novell's Access Server, and Vestra-Subco's LANMaster IncomServ.

Our editorial filter required that the products each be tried, tested, and sold as a complete package from a single vendor. Many companies sell the bits and pieces, such as multiport serial boards and multitasking software, but wickering those parts together is a task for a highly skilled masochist. Our advice is to buy an integrated package like those in this review.

In addition to being offered by the company as a complete remote-control turnkey solution, the product had to be able to handle four or more telephone lines simultaneously. And though we did not require it, most of these solutions allow each user to have a unique log-on ID for the access server.

The products we reviewed use one of two architectures. Those using the multitasking approach are the 386/MultiWare, the LANMaster IncomServ, and the Access Server. Those using the multi-CPU architecture are the PC-Slave/286 and XBUS4/AT, the ComBridge, the FlexCom, and the ChatterBox 4000.

A product from David Systems which should be shipping by the time you read this will offer features and add-ons that will allow it to function as an asynchronous access server, an Ethernet bridge, and an IPX router, with the option to connect to T1 circuits (see the sidebar "Just Down the Road: Asynchronous Server 64 Promises To Be a Flexible LAN-to-LAN Alternative"). The Connection Manager, marketed by Softwarehouse Corp., was not available in time for review. Additionally, at press time Shiva

Corp. had announced the NetModem/E, a standalone device incorporating an Ethernet interface and a 9,600-bps modem, which will allow remote users to dial into an Ethernet network and dial out via the network over a single phone line.

Unlike the systems we reviewed, some products allow remote users only to call into a dedicated or nondedicated access server that acts as a switch to another PC on the network—their own or one to which they have rights—that is running the remote-control software. From there, the user is able to run applications. (See the sidebar "More Options For Dialing In and Out: Using Access Servers To Remotely Control Networked Workstations.") This approach is acceptable for casual use, but it does not provide the same solid solution for organizational remote access as these products.

All the access servers we review here employ DOS-based remote-control programs. While the multitasking nature of OS/2 makes it appropriate for access-server duties, there are few OS/2 remote-control applications and most of them are not sold as part of a complete turnkey access-server solution (see the sidebar

"Three Solutions for Remotely Controlling an OS/2 Workstation: *DCAF*, *PolyMod2*, and *Remote-OS*"). IBM's *DCAF* can be part of a complete solution, but it was not included in the main review because it does not let you run DOS applications on the computer you call into; you remotely control a DOS computer through the OS/2 machine.

SIMILARITIES AND DIFFERENCES

Setting up one computer to handle one call is easy, but large networks need to allow many people to call in simultaneously. Managers do not want to dedicate one computer to each phone line; that technique wastes space and money.

When you dial into the network, the remote-control programs used by the products we reviewed greet you with a log-on prompt. Once logged on, the dialing PC acts as if it is on the network, although the processing actually takes place at the other end of the phone line. Until you hang up, the remote-control program controls what you do.

Most of the CPU cards available for the systems we reviewed support some level of graphics. But sending graphics images over a modem—even a 9,600-bps model with data compression—can be slow, so you will probably want to control only character-based applications.

The difference among these products lies primarily in the two techniques used to handle multiple simultaneous calls. As mentioned above, the first technique, employed by the 386/MultiWare, the LANMaster IncomServ, and the Access Server, uses a multitasking operating system to slice the power of a single 80286 or 80386 processor into several simultaneous sessions. Each calling PC controls one session on the multitasking operating system.

You cannot run out, buy *DESQview* 386, and create this type of system yourself, because the transport-layer software used in *NetWare* and other LAN operating systems expects to service only one user ID per LAN adapter card. For example, if you try to service more than one caller through a multitasking operating system using a standard version of Novell's IPX, *NetWare* would log on the first user a second time, as the second user, when a second caller logs on as a different user than the first. The first user would no longer have the correct privileges and drive mappings.

To correct this potential problem, Novell developed a special multiplexing version of its IPX software for its Access Server; Alloy reuses it in the 386/MultiWare.

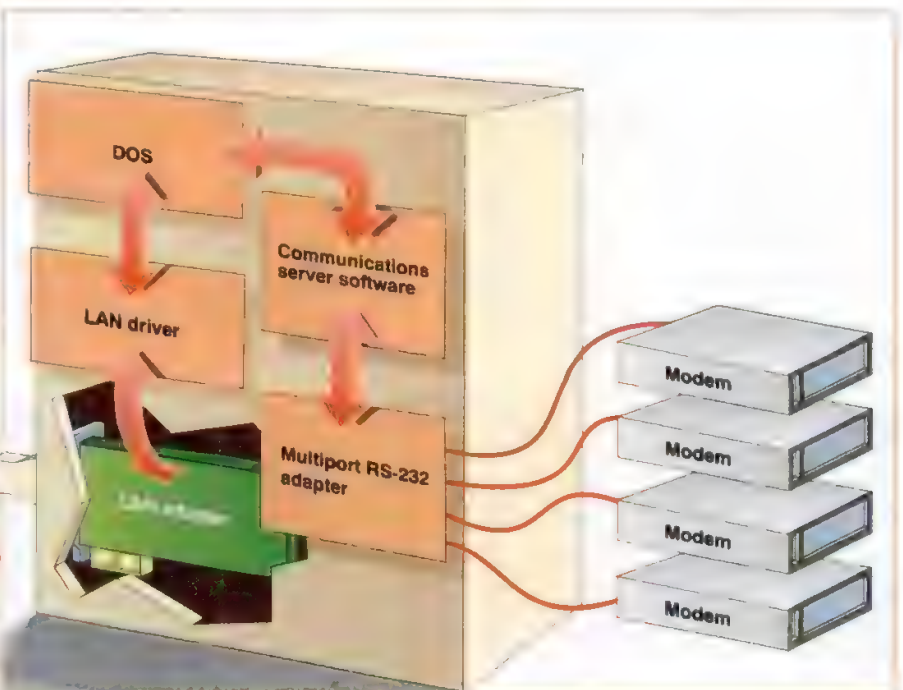
As a rule, the advantage of the multitasking architecture is its cost. Equipped with one of these packages, a single 20-MHz 386 PC can handle five simultaneous callers. The disadvantages of this approach are its unreliability, as well as the throughput when more than four users call in simultaneously. Some ill-behaved programs will bring down the session or the whole server in any multitasking operating system, and you may have difficulty controlling what applications the callers try to run on the access server. If the system crashes, somebody on-site must reset the session or the server. If a crash occurs over the weekend, your system might not become fully operational until Monday morning. Also, when several serial ports share one CPU, the CPU's inability to efficiently handle the frequent interrupts that occur in high-speed communications limits the throughput available to more than four or five stations.

The other technology, used by the PC-Slave/286 and XBUS4/AT, the ComBridge, the FlexCom, and the ChatterBox 4000, employs multiple processor cards mounted in a single chassis of the vendor's design. Calling PCs control one of several separate 80286 or 80386 proces-

sors in a card cage or a host PC. While this design is generally more expensive than a multitasking operating system, low-end CPU cards offer entry-level processing power at a very reasonable cost.

Unlike the multitasking products, most systems using the vendor's special card cage—the ChatterBox is an exception—typically require the use of a processor card running Novell's BRGEN software to route IPX packets onto the network. (The products that use Novell's bridge software run only on *NetWare* LANs. It's also worthwhile to note that BRGEN has been replaced, in *NetWare* 2.2 and 3.11, with ROUTEGEN. But since all the bridge products included support for BRGEN but not always for ROUTEGEN, we used BRGEN in the evaluation process.) Since the processor cards that act as a bridge along with the LAN adapter do not usually have a disk drive attached to them, you need an alternate way to boot. *NetWare* provides a mechanism to simulate a disk drive by plugging a ROM chip onto the network adapter; this ROM chip talks to the network and requests DOS from the network server.

The card-cage cabinets range from the small XBUS4/AT, through several styles of the ChatterBox that look like a cross between an AT and a high-performance stereo amplifier, up to the ComBridge, a heavy-duty customized rack for modems and CPU cards that looks at home nestled among the cabinets of an IBM mainframe.



dFacts Are In.

DATABASE COMPARISON TABLE	dBASE IV version 1.1	Paradox version 3.5	FoxPro version 1.02
EASE OF USE			
Control Center organizes data, queries, forms, reports, labels, applications on <u>one</u> screen	Yes	No	No
Create applications <i>without programming</i>	Yes	Yes	No
Modern pulldown menus for all Design Tools	Yes	No	Limited
Query by Example (QBE) for easy access to information	Yes	Yes	No
Context specific help by menu item	Yes	No	No
PRODUCTIVITY			
Quick Layout for automatic forms, reports <u>and</u> labels	Yes	No	Yes
Application Generator for quick application development	Yes	Yes	No
Automatic code generation for all Design Tools	Yes	No	No
Automatic maintenance of <u>multiple</u> indexes for ordering data	Yes	No	No
Memo fields for notes, letters, descriptions	Yes	No	Yes
POWER & FLEXIBILITY			
Bold, underline, italic, subscript, superscript text for high impact reports and labels	Yes	No	No
User Defined Functions for extending programming language	Yes	No	Yes
Data input validity checking in forms	Yes	Yes	Yes
Multi-user transaction processing ensures data integrity	Yes	No	No
Number of file formats imported/exported	7	6	3
INDUSTRY STANDARDS			
#1 Selling, #1 Rated multiuser database; over 3 million users (1)(2)	Yes	No	No
Compatible with dBASE III PLUS data and applications	Yes	No	Yes
Compatible versions for DOS, VAX VMS, Macintosh, SunOS and other UNIX platforms (3)	Yes	No	Limited
Structured Query Language (SQL) integrated with programming language	Yes	No	No

(1) dBASE III PLUS and dBASE IV comprise approximately 55% of PC database systems sold - 3 times nearest competitor - according to the most recent report by the market research firm Audits & Surveys (Oct. 1990). (2) Software Digest rated dBASE IV #1 among multiuser databases (October 1990). (3) Versions of dBASE IV are shipping for DOS, VAX, and SunOS. Macintosh and other UNIX Platforms are announced.

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many categories.

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Software Digest rates dBASE IV version 1.1 the #1 Multiuser Database (Vol. 7, No. 13, Oct. '90).

dTruth Comes Out.

Software Digest **RATINGS REPORT**
 Volume 7 Number 13
 The Independent Comparative Ratings Report for Selecting IBM PC Business Software

MULTIUSER DATABASE PROGRAMS

Ratings Key: ■ 70-10.0 ■ 50-6.9 ■ under 5.0

Software Digest Rating	Overall Evaluation	Overall Power	Program Name	Version Tested	Performance	Reliability	Error Handling	Ease of Learning	Ease of Use	Memory Requirement	Price	Volume Purchase Agreement	Page
***	7.0	6.7	dBase IV	1.1	■	■	■	■	■	450KB	\$795	✓	28
**	6.8	5.1	Paradox	3.5	■	■	■	■	■	640KB	\$995	✓	32
**	6.8	7.1	FoxPro/LAN	1.02	■	■	■	■	■	512KB	\$1095	✓	30
**	6.4	5.1	DataEase	4.2	■	■	■	■	■	640KB	\$750	✓	26
*	5.8	3.6	R-Base	3.0	■	■	■	■	■	520KB	\$995	✓	34
*	5.7	6.0	Clarion Professional Developer	2.1	■	■	■	■	■	512KB	\$845	✓	24
*	5.7	6.6	Advanced Revelation	2.01	■	■	■	■	■	640KB	\$995	✓	22

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Perhaps the most independent publication in the industry, *Software Digest* accepts no advertising whatsoever. Corporations pay hundreds of dollars a year to receive their monthly reviews—which are considered highly unbiased and objective. Their exhaustive, 75-page report concludes:

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dBASE IV

 Ashton-Tate

These card-mounted processors might share a single network adapter card, as with the ComBridge and the XBUS4/AT, or each CPU might get the full attention of its own LAN adapter card, as with the ChatterBox. As our performance tests demonstrate, when callers control a CPU that provides its own LAN adapter card, they get faster network performance. However, this approach can cost \$500 to \$1,000 more per available call-in port than the architecture that uses a multi-tasking host on the LAN.

The costs of all of these products depend on what equipment you already have and how you want to use it. You do not have to mount Alloy's PC-Slave/286 or Cubix's CPU cards in separate cabinets; they can run in an old AT-style computer, as long as it contains sufficient slots for your needs. (The J&L CPU cards do need their own special cabinet; the FlexCom is sold only as a self-contained unit.)

DIALING OUT

All of the products, with the exception of Novell's Access Server and Alloy's XBUS/4AT and 386/MultiWare, can also act as modem servers. You should note that these products can require the use of some special hardware and software to function in this capacity.

A network modem server is a specific subcategory of communications servers. A modem server makes a group of modems, as many as 16 in the Cubix product, available to the client workstations on a first-come-first-served basis. People at the client stations use general-purpose communications software able to work across the network, such as DCA's *Crosstalk Mk. 4*, to establish a dedicated connection to a modem in the pool. The modem server gives the PC winning its services its full attention for as long as the call lasts, a condition called a virtual circuit.

At first glance, it may not seem to make sense to share modems, since even 9,600-bps modems are rapidly decreasing in price. But each business telephone line can cost \$70 to \$100 per month, and there are barriers to putting a modem on every PC besides the cost of the modems and phone lines. Many office telephone systems are not designed to accept modems. In some buildings, running the phone wires themselves presents a problem. If you already have an installed LAN, you can add a modem server to avoid other costs.

There is a catch. In order for the attached PCs to be able to use the modem

server, each workstation needing access to it must be provided with a redirector to send the serial communications traffic to that server.

Some redirectors are software-based and some combine hardware and software. The hardware-based approach employed by J&L allows you to use unmodified, off-the-shelf communications software in the workstation PC. The trade-off is that you must use one of the workstation's expansion slots for the redirector card that emulates the serial port's UART chip. The other disadvan-

tage to this approach is that only redirector-equipped PCs have access to the modem server, but you might consider this restriction a security feature.

You can also use software redirectors tailored for specific LAN operating systems, but only a few communications applications can generate the special software interrupt needed to interact with software redirectors.

The designers of Microsoft's DOS originally intended for communications software to access the serial ports through software interrupt 14 hexadecimal, or INT14. But because using INT14 is so slow, communications software design-

GLOSSARY: Access Servers

by M. Keith Thompson

■ access server

A machine that provides access to the network for computers dialing in, allowing remote users to access LAN resources as if the users were sitting at computers directly attached to the network. Access servers can consist of a specially built cabinet of multiport CPU cards designed to handle multiple inbound calls simultaneously, or can be made of multiport CPU cards that you install on a networked PC.

■ bridge

A computer using *NetWare's* BRGEN software to route IPX packets onto the network. Often, bridge products are included in multi-CPU access-server designs and share one network adapter housed in a single cabinet.

■ gateway

A computer controlling multiple modems for both inbound and outbound calls.

■ host

The CPU on the access server that answers the phone and provides access to the network.

■ INT14

A software interrupt designed to communicate with the comm port in a PC. Communications programs use interrupt 14h to talk to a modem physically attached to another computer on the network.

■ modem server

A networked computer with a modem or group of modems attached to it that allows network users to share the modems for outbound calls.

■ multi-CPU architecture

Multiple-CPU design uses one CPU for each user calling into the network. Although the multiple CPUs can be housed in one cabinet, they act individually. Each CPU has its own serial port, allowing it to devote its full attention to one caller.

■ multitasking

Multitasking access-server products use the Virtual 86 mode of 386- and 486-based computers. They share the same network adapter and use intelligent multiport serial cards to handle simultaneous phone calls.

■ remote

Remote computers run a remote-control or terminal-emulation program to call into the host computer and access the network.

■ remote control

In this article, *remote control* refers to operating another computer over a communications link. With remote-control software, your keyboard and screen become more or less synchronized with the computer to which you are attached, allowing you to run programs on the host and see the results on the remote screen.

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CONNECTIVITY ACCESS SERVERS

ers typically address the PC serial port's UART hardware directly. When IBM introduced the IBM Asynchronous Communications Server (a dial-out product only), it defined how a communications program should talk to the server. But the specification, which also calls for using INT14, has had little acceptance. When Novell introduced the Novell Asynchronous Communications Server, it came out with another interface specification. Based on interrupt 6Bh hexadecimal, it is probably used no more than INT14.

FLEXIBLE CHOICES

This review includes access servers with a variety of architectures, costs, cabinets, and capabilities. You will see a clear trade-off between cost and performance when

more than a certain number of users simultaneously call into the access server. If the users in your organization need only to use word processing programs and check their electronic mail, then the multitasking approach will meet your needs, especially if you do not expect more than five users to call in at once. Multitasking products may even be able to handle CPU-intensive tasks involving calculations or jobs like sorting database records, but the separate-CPU approach offers more power for these tasks when many simultaneous remote users are involved. In either case, these turnkey access servers can provide an excellent portal for PC-to-LAN and LAN-to-LAN connectivity.



EDITORS' CHOICE

■ ChatterBox 4000

J&L Information Systems' ChatterBox 4000 clearly stands head and shoulders above its competitors. Packaged in a tower-style case slightly larger than the IBM PS/2 Model 80, the product's multiple-CPU architecture is enhanced by a design that provides each CPU with access to its own LAN adapter. This hardware-intensive approach let the ChatterBox 4000 achieve the best performance times of all the products we reviewed.

In a product category where Alloy's shared-CPU 386/MultiWare package costs a low \$355 per port, the \$2,070-per-port cost of the ChatterBox may seem high at first. But in fact, based on a four-port comparison price, it is one of the least expensive of the multiple-CPU products we reviewed. Of course, the fact that you must purchase a LAN adapter for *each* CPU adds to the cost, but excellent Ethernet adapters can have a street price of only \$150. In addition, the ChatterBox itself costs less than many PCs you might buy for a shared-CPU system.

The ChatterBox offers other features that make it an invaluable asset. Its ability to reset its own CPU boards when they lose the

modem carrier can avoid the problem of hung sessions. A circuit keeps the phone line busy while the CPU is resetting after a call, ensuring that no calls come into a computer not ready to accept them. The product includes LEDs that show the status of the processors' serial ports and has room for up to six half-height storage devices. If you are looking to get the most from your money, you will also appreciate the ChatterBox's ability to function equally well as a modem server.

If the four-CPU version we reviewed is insufficient for your needs, the company also offers a model that can host as many as nine separate processors. That means you can dedicate some processors to acting as access servers, some to acting as modem servers, and some to performing other roles, such as e-mail gateways. Best of all, you can adapt the processors to each task as needed without being concerned about compatibility with the bridge software, no matter what version of the ChatterBox you choose. Unlike all the other multiple-CPU products, which require NetWare's BRGEN, the ChatterBox is not limited to running on NetWare LANs.

ALLOY COMPUTER PRODUCTS INC. PC-Slave/286 and XBUS4/AT

by M. Keith Thompson
and Steve Rigney

Unlike some other access servers with hefty housings, Alloy Computer Products' XBUS4/AT looks no bigger than a bulky toaster; in fact, you might want to think of it as a toaster on steroids. The five-slot box, measuring 9 by 5 by 16 inches (HWD), provides an expansion chassis to house four of Alloy's PC-Slave remote-control processor cards and an extender card. The XBUS4/AT chassis costs \$995, while the PC-Slave cards sell for either \$695 or \$1,195, depending on the CPU. All adapters come with *LINK-PC*, Alloy's modem remote-control software. Although this hardware/software solution essentially provides only dial-in services, it offers the least expensive way to get individual dedicated CPU processing in an access server on NetWare LANs, especially if you do not need to purchase the chassis.

You do not have to buy an XBUS to create an access server with the PC-Slave cards; you can mount them in any ISA-bus PC, as long as it has a sufficient number of free slots to meet your remote-access needs. The XBUS, on the other hand, gives you the flexibility to use practically any PC with the access server, without worrying about the number of available slots. But like all the bridge



FACT FILE

PC-Slave/286 and XBUS4/AT

Alloy Computer Products Inc., 165 Forest St., Marlboro, MA 01752; 508-481-8500.

List Price: PC-Slave/16N, \$695; PC-Slave/286, \$1,195; XBUS4/AT, \$995; XBUS12/AT, \$1,495; XBUS4/MC, \$1,195; XBUS12/MC, \$1,695.

Requires: 286-based PC or better, 1MB RAM, DOS 3.1 or later, network adapter.

In Short: The PC-Slave's V20 or 286 CPU cards can run inside a PC up to the limits of the space available or in the XBUS, a separate expansion chassis. Installation is not easy, but PC-Slave boards represent an economical way to get individual dedicated CPU processing in an access server.

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systems we reviewed, the XBUS lacks connectors for a keyboard or monitor on its remote-control CPU cards, although all the products using this technology do offer monitor connections on the card that runs the bridge software.

THRIFTY CONNECTIONS

Alloy offers several models of the XBUS and PC-Slave, including the PC-Slave/16N, a \$695 CPU card equipped with an

8088-class processor running at 8 MHz, 768K of RAM, and the NEC V20. For \$1,195, the PC-Slave/286 card comes fitted with a 12-MHz 80286 processor and 1MB of RAM. Alloy sent us the PC-Slave/286 cards to test in the XBUS4/AT.

Alloy also sells XBUS models that can hold 12 PC-Slave cards. Its PC-Slave boards are all of the ISA design. The

company makes XBUS models for Micro Channel architectures; these include an MCA extender card in the XBUS box. (The ISA-based PC-Slave boards will not install in a standard Micro Channel machine, however.)

The product line offers a good investment for the budget-minded. Combine the \$995 XBUS4/AT with four PC-Slave/286 CPU cards and you will pay about \$1,433 per port, plus the cost of the AT-

MORE OPTIONS FOR DIALING IN AND OUT: Using Access Servers To Remotely Control Networked Workstations



by M. Keith Thompson

The asynchronous LAN access servers we reviewed let you connect to the network but, in most cases, not to network workstations that you or anyone else uses. But what if you want to dial in and run a particular PC's local and network applications? Our review criteria filtered out three products worth considering: *Cross+Connect* from Cross Communications, *MultiComAsyncGateway* from Multi-Tech, and *Telebit ACS* from Telebit Corp. These products provide both remote-access and modem-sharing services. But instead of giving you remote control over network resources, they let you access the network via modem and then redirect you to another network workstation you can control remotely.

Cross+Connect lets you dial into one of several nondedicated access serv-

ers and then decide which PC on the network you would like to remotely control. *MultiComAsyncGateway*, after it allows you to dial into a single dedicated access server, then redirects you to your own networked PC. *Telebit ACS* also presents incoming callers with a list of workstations available for access, provided the user has the correct ID and password.

Cross+Connect is a combination of Cross Communications' *LAN+Modem* and *In+Touch* products. The all-software product requires little memory and works on both *NetWare* and *NetBIOS* LANs. At \$995 for the five-modem version, *Cross+Connect* provides a low-cost entry to the remote-access market and grants the added benefit of modem sharing.

Since *Cross+Connect* does not require a dedicated computer as the asynchronous gateway or access server, it can support standard serial ports on multiple computers. This lets you use the computer as a normal network workstation while it answers calls, but poses a potential problem. Any time you share a computer and make it do multiple tasks in the DOS environment, you cannot depend on the computer staying alive.

The computers with modems at-

tached handle both incoming and outgoing calls without conflicts. When modems are in use, *Cross+Connect* marks them as busy and unavailable to other users on the network. A small 7K TSR runs on computers with attached modems and displays a menu of the computers on the network available to be taken over. Once you attach to a remote computer, you can run programs just as if you were typing on that computer's keyboard. *Cross+Connect* works only in text mode and does not handle any graphics.

Cross+Connect's asynchronous gateway supports communications software with *INT14* implemented. This lets users share the modems distributed throughout the network, saving money and wiring costs. The modem-sharing facilities also include background mail-transfer capabilities. *Cross+Connect* also includes a basic terminal-emulation program. The *Cross+Connect* system will handle speeds only up to 19,200 bits per second, however. If your network uses high-speed modems, that could limit the transmission rate to half the throughput of most other products that we reviewed.

Cross+Connect works well and offers a good solution for small companies wanting a low-cost answer to their dial-in and dial-out needs. It is not designed for critical applications or heavy-duty use.

MultiComAsyncGateway comes in a variety of configurations designed to fit any company's needs. It provides both incoming and outgoing modem

CONTINUES



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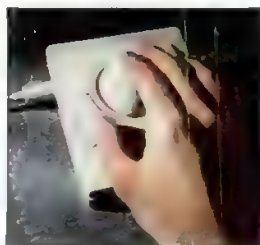
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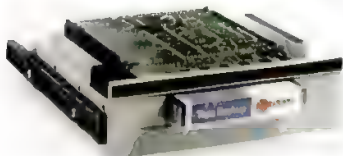
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CIRCLE 473 ON READER SERVICE CARD

class PC with 1MB of RAM needed to run the bridge software and hold the LAN adapter. If you estimate that PC at \$1,000, then the price of the XBUS4/AT solution comes to \$1,693 per port. This is not far from the price of Novell's Access Server multitasking solution and it gives you roughly the same performance. You will pay only about \$943 per port (sans the cost of the PC) if you opt for the V20 processor cards.

MORE OPTIONS FOR DIALING IN AND OUT

CONTINUED
services and works over NetBIOS networks.

Multi-Tech offers several different combinations of products to solve your problems. The \$995 four-port system includes the software and hardware necessary to handle four 9,600-bps connections, using *pcAnywhere IV* for remote access. The more advanced eight-port solution, costing \$2,495, is expandable to 16 ports and can handle a 38,400-bps connection in each port, but it does not include the remote-access software. Other combinations are available as well.

Installation is not difficult, but you have to spend some time defining users and network addresses. MultiCom-AsyncGateway requires at least a 286-based computer as the access/gateway server, while *Cross+Connect* lets you use an XT.

Multi-Tech's gateway software controls and manages communications across the network, while its connection manager handles incoming calls from the modem. To set up their computers to be taken over, users on the network establish a connection to the gateway from their PCs and run AWHOST before leaving the premises. When they call in from the remote location with ATERM, the gateway software answers and asks for their user ID and password. Once it validates the answers, the gateway connects them to their own networked computers.

MultiComAsyncGateway handles calls well, but requires users to know before they leave the office for the night that they will want to get back into the

In the PC that runs the *NetWare* external router software and provides access to a single shared LAN adapter card, a thick cable connects the extender card and a single 16-bit slot. The PC must be dedicated as a communications server.

In addition to a processor, both PC-Slave models include two serial ports and can emulate EGA or Hercules mono-

network later. Although it's primarily designed for someone who has a computer at the office and wants to access it remotely, the added benefit of modem sharing makes it a nice option for thrifty companies.

Like the other two products, the Telebit ACS operates as an asynchronous gateway and doubles as a remote-access computer. The Telebit ACS works over both *NetWare* and NetBIOS networks. The \$3,995 product includes an eight-port serial card, Digital Communications Associates' *Crosstalk Mk.4* communications software with a license for eight simultaneous users, and *pcAnywhere/IV LAN* with a license for an unlimited number of simultaneous users on the network. Telebit ACS, which can reside in a 286-based PC, handles calls well with its intelligent multiport serial card.

The Telebit ACS allows you to expand your system as your needs grow. The eight-port solution can grow into a 32-port gateway by simply adding three more eight-port cards. Each port can handle connection speeds of up to 38,400 bps.

Installation is quick and easy. You install the software in a public directory on the LAN and run the gateway as the boot process. Telebit's gateway software handles calls coming in from the modem by presenting a list of workstations available for use. If users want to access their systems while away, they simply set up the machines to be taken over before they leave the office. The users can later call in from remote locations with ATERM. After they select their networked PC from the list, *pcAnywhere IV/LAN* asks for a user ID and password. Once validated by the system, users then have control of their own PC on the network and access to the

chrome graphics. The cards can communicate only with standalone remote PCs or with users calling in from a modem server through serial devices like modems and terminals. Since they boot from the LAN server as diskless workstations, you can load the modem remote-control software through a command in the DOS boot image.

An incoming caller connects to the first serial port on the CPU card associ-

LAN as if they were sitting at their own desks.

The Telebit ACS is costly, but it does provide a high-quality dial-in and dial-out solution with plenty of room for expansion.

Cross+Connect, Version 1.2

Cross Communications Co., Canyon Center, 1881 9th St., #302, Boulder, CO 80302-5151; 303-444-7799.

List Price: 1-modem version (unlimited users), \$495; 5-modem version, \$995; 20-modem version, \$1,995. **Requires:** IBM-XT, AT, or compatible; 7K RAM for dial-in; 18K for dial-in and dial-out; network interface card; DOS 3.0 or later; NetBIOS network or *NetWare*.

CIRCLE 396 ON READER SERVICE CARD

MultiComAsyncGateway

Multi-Tech Systems Inc., 2205 Woodale Dr., Mounds View, MN 55112; 800-328-9717, 612-785-3500.

List Price: 4-port system with *pcAnywhere IV*, \$995; 8-port system without *pcAnywhere IV*, \$2,495; 16-port system without *pcAnywhere IV*, \$3,494. **Requires:** 256K RAM, 286 or 386 computer, network interface card, NetBIOS network, DOS 2.0 or later.

CIRCLE 397 ON READER SERVICE CARD

Telebit ACS

Telebit Corp., 1315 Chesapeake Terr., Sunnyvale, CA 94089-1100; 800-835-3248, 408-734-4333.

List Price: 8-port ISA version, \$3,995; 16-port MCA version, \$5,995. Both versions include LAN license agreements for *Crosstalk Mk.4* and *pcAnywhere IV/LAN*. **Requires:** 286-based PC or better, NetBIOS network or *NetWare* 2.1 or later. For dial-in, 60K RAM (can be loaded into high memory).

CIRCLE 398 ON READER SERVICE CARD

CONNECTIVITY ACCESS SERVERS

ALLOY COMPUTER PRODUCTS INC.

386/MultiWare

by M. Keith Thompson

.....

Alloy's 386/MultiWare provides a multitasking DOS environment that allows a single remote user to dial in on one line and run as many as eight DOS sessions on the host. The 386/MultiWare's multitasking approach sets it apart from the company's XBUS/PC-Slave system, a bridge product. At \$2,839 plus the cost of an i386 or i486 computer, it achieves maximum flexibility at a good price/performance ratio, offering an eight-port solution that performs well and offers convenient access to the resources of *NetWare* LANs.

The 386/MultiWare package provides some real benefits to large and small *NetWare* networks. The complete Alloy turn-key solution includes the \$995 MW386, a 21-user version of the multitasking operating system, a \$1,695 Imp 8 intelligent eight-port serial adapter, Alloy's \$149 Multi-Node driver, and *LINK-PC* remote-control software with terminal-emulation capabilities. MultiWare's multitasking approach allows it to supply a low-cost product, priced at about \$355 per port, plus the cost of the computer. Of course, you will also have to add the price of a modem for each port.

FACT FILE

386/MultiWare

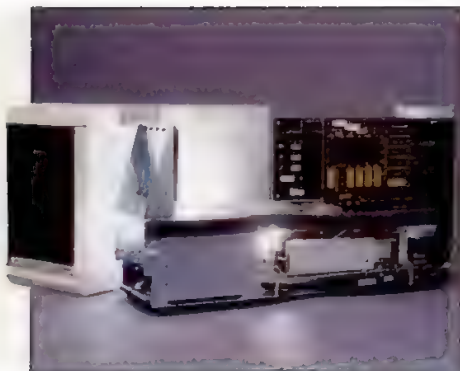
Alloy Computer Products Inc., 165 Forest St., Marlboro, MA 01752; 508-481-8500

List Price: MW386 (21-user version of multitasking operating system), \$995; MW386E (5-user version of multitasking operating system), \$595; Imp 2 (2-user board), \$495; Imp 8 (8-user board), \$1,695.

Requires: i386/i486 computer, network adapter, 2MB RAM, DOS 3.0 or later.

In Short: 386/MultiWare performs nearly as well as its multiple-CPU sibling, the XBUS/PC-Slave combination, and is simple to install. A low-priced multitasking solution, it includes extra administrative and security features. More importantly, it provides a multitasking DOS environment that allows a single remote user to dial in on one line and run as many as eight DOS sessions on the host.

CIRCLE 404 ON READER SERVICE CARD



Alloy's \$995 XBUS4/AT chassis holds four \$1,195 PC-Slave/286 CPU cards, which can also be installed in any ISA-bus PC. The XBUS4/AT is only about the size of a bulky toaster—smaller than the expansion chassis of some communications servers.

ated with the incoming phone line. The second serial port on each CPU card is available for any purpose, including use with a second outgoing modem. Aside from this limited capability, the XBUS system does not provide modem pooling for the other networked PCs.

COMPLEX INSTALLATION

With or without the XBUS cabinet, you will not find the PC-Slave system simple to install. You must carefully configure a number of switches on each CPU card, set up the multiplexing IPX software, and configure the Novell remote-bridge software. Even with luck and experience, the project still takes a full day.

In our performance tests, the XBUS/PC-Slave system generally provided above-average throughput. It should easily keep up with the latest V.42bis modems. Our tests also found a potential bottleneck at the LAN adapter when many processors tried to access the network simultaneously.

Alloy provides unlimited free technical support for its products from 8 A.M. to 8 P.M., E.S.T. The company also offers a BBS for user support.

The PC-Slave/XBUS system represents the least expensive choice among the multiple-CPU multiport access servers we reviewed, particularly if you use an old 286 AT as the host for the PC-Slave cards. Although the individual CPU cards, especially the PC-Slave/16N, do not have the processing power of the cards sold by J&L or Cubix, they offer plenty of throughput for typical remote-access jobs such as exchanging electronic mail and transferring files.



Alloy's \$2,839 386/MultiWare bears little resemblance to the XBUS4/AT from the same company. 386/MultiWare consists of multitasking software and the Imp 8 eight-port serial adapter, which you attach via cable to the serial port of a 386- or 486-based computer. You then attach your modems to the ports on the Imp 8.

SPECIAL NETWORK DRIVER

Multi-Node is a special network interface card driver that includes the IPX protocol, allowing 386/MultiWare host computers to connect to *NetWare* LANs. What makes this IPX driver special is its ability to handle multiple user log-on names on one network interface card, although the Ethernet network adapters the driver supports are limited to NE1000s and NE2000s.

The 386/MultiWare's ability to handle multiple log-on names allows each caller to have a unique identity on the network. Other products we reviewed, such as LANMaster IncomServ, require that each user dialing in inherit generic access rights. By giving each user individual access rights and a user name, the 386/MultiWare greatly improves administration and security.

The package's simple installation allows you to be up and running in about half an hour. Just attach the Imp 8 serial adapter, which does not install in the PC, to the 386- or 486-based host machine with a fat cable and attach the modems through the Imp 8 adapter. After feeding the computer the four installation disks, you reboot the machine, and the 386/MultiWare is up.

MULTITASKING DOS SESSIONS

The Imp 8 adapter comes with its own memory and a V30 processor to control and buffer the incoming data. Its 576K of memory holds screen images, allowing four calling terminals to use Hercules

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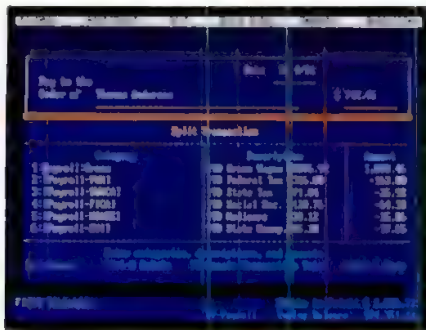
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CONNECTIVITY

ACCESS SERVERS



ACCESS SERVERS: SUMMARY OF FEATURES

Products listed in ascending price order

	Access Server	386/MultiWare	LANMaster IncomServ	PC-Slave 286 and XBUS4/AT	ChatterBox 4000	FlexCom	ComBridge
List price (tested configuration)	\$1,995	\$2,839	\$2,999	\$5,775	\$8,280	\$11,175	\$13,430
CPU CONFIGURATION							
Shared CPU card with multitasking operating system	■	■	■	┐	┐	┐	┐
Multiple CPU cards	┐	┐	┐	■	■	■	■
CPU cards available from vendor:							
386SX	N/A	N/A	N/A	┐	■	■	■
286	N/A	N/A	N/A	■	■	■	■
Dual 286	N/A	N/A	N/A	┐	┐	┐	■
Each CPU card uses own LAN adapter	N/A	N/A	N/A	┐	■	┐	┐
Can use special CPU-card cage	┐	┐	┐	■	■	■	■
OPERATING SYSTEMS							
Requires processor running BRGEN software	┐	┐	┐	■	┐	■	■
Compatible with NetWare 2.2	■	■	■	■	■	■	■
Compatible with NetWare 3.11	■	■	■	┐	■	■	■
Compatible with NetBIOS networks:							
LAN Manager	┐	┐	■	┐	■	┐	┐
LANtastic	┐	┐	■	┐	■	┐	┐
DIAL-IN/DIAL-OUT CAPABILITIES							
Remote-control software included	OnLAN/PC	LINK-PC	Incom Reach	LINK-PC	Co/Session	pcAnywhere IV/LAN	Sparkle
Allows multiple simultaneous users with different log-on IDs	■	■	┐	■	■	■	■
Maximum port speed (bps)	38,400	38,400	57,600	38,400	57,600	57,600	57,600
Maximum number of incoming lines	4	4	4	8	4	6	8
Monitors and controls phone lines	┐	┐	┐	┐	■	┐	┐
Functions as modem server	┐	┐	■	┐	■	■	■
Maximum number of outgoing lines	N/A	N/A	4	N/A	4	6	16
Hardware redirection	N/A	N/A	┐	N/A	■	┐	┐
Software redirection	N/A	N/A	■	N/A	■	■	■
Uses interrupt 14h	N/A	N/A	■	N/A	■	┐	■
Uses interrupt 6b	N/A	N/A	┐	N/A	■	■	┐
Uses Novell's NASI standard	N/A	N/A	┐	N/A	■	■	■

■—Editors' Choice ■—Yes ┐—No

N/A—Not applicable: The product does not have this feature

graphics and the rest to function as text terminals. Each remote user calling in receives the resources of all the EMS 4.0 memory that he or she needs. The Alloy product uses the Virtual 86 mode of the i386 or i486 processor to treat each caller as an individual user. Users have 522K of memory available for each DOS session.

On the remote workstation end, you need to run the *LINK-PC* software to control the session on the network. The program, also supplied with the company's PC-Slave/XBUS combination, is simple to use, but limited in functionality. Unlike the other products we tested here, *LINK-PC* does not include a chat facility or allow you to capture your incoming screens to disk. And although *LINK-PC*

can transmit text or Hercules monochrome graphics, transmitting color or higher-resolution graphics over modems is not feasible.

The ability to have a single user run up to eight sessions on the host constitutes the 386/MultiWare's best and most useful feature. For example, after starting a file transfer in one session, you can switch to a second window and run another program. Bear in mind that the more things you try to do over the modem link to the host, the more you will affect the other processes.

SIMILARITIES WITH XBUS

Interestingly, 386/MultiWare's throughput did not differ markedly from that of its individual-CPU sibling, the combina-

tion of the PC-Slave/286 and the XBUS4/AT, although the combination performed better.

As with the company's other products, Alloy supports 386/MultiWare by operating a BBS and offering free, but not toll-free, technical support for its users from 8 A.M. to 8 P.M., E.S.T.

386/MultiWare provides excellent DOS compatibility, although it offers no dial-out abilities. As a complete package, it provides a good solution if you are trying to get maximum productivity out of an existing i386 or i486 computer. And if your company needs to do more terminal-emulation work than file transfers, 386/MultiWare is the only product that allows the remote computer to run multiple sessions over a single phone line.

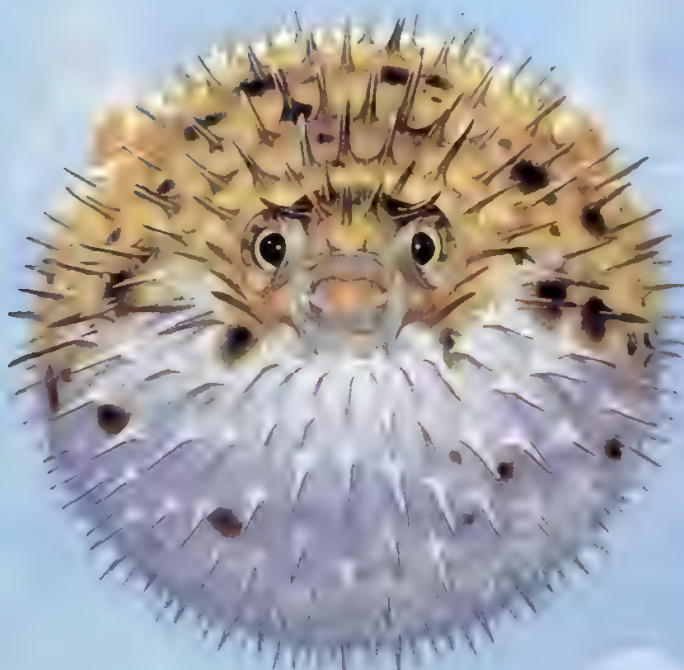
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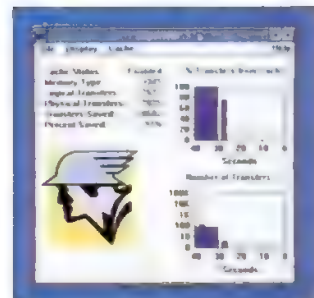
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CONNECTIVITY ACCESS SERVERS

CUBIX CORP. **ComBridge**

by M. Keith Thompson

Well-designed and well-made, Cubix's ComBridge can provide both dial-in and dial-out communications services on your network. Its architecture employs multiple CPUs controlled by a 386SX central processor running NetWare's remote-bridge software. The multiple CPUs connect to the LAN through a single network adapter card. You can run the Cubix CPU cards in any 286 or 386 PC with a sufficient number of free 16-bit slots, but organizations needing more than a few lines will want to use the attractive and substantial \$10,640 cabinet offered by Cubix.

Made of heavy-gauge metal with a smoked plastic front, the ComBridge cabinet measures an impressive 4 by 2 by 2 feet. The plastic front lets you view the lights on modems that you have mounted in the ComBridge cabinet, as many as 16. The cabinet also holds a slide-out drawer with a ten-slot backplane. Each backplane slot can contain a card with either dual



Cubix's \$10,640 ComBridge, made of heavy-gauge metal with a smoked plastic front, stands 4 feet tall. The ComBridge has room to mount up to 16 modems and as many as 10 of Cubix's custom-designed, custom-built CPU cards.

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THE SCORES



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*Mike Heck, Doug and Denise Green,
InfoWorld June 17, 1991.



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CIRCLE 729 ON READER SERVICE CARD



BENCHMARK TESTS: ACCESS SERVERS

Access-server architectures offer a variety of hardware alternatives and costs, but their test scores make it difficult to generalize about the comparative performance of shared-CPU products and dedicated-CPU products. J&L's hardware-intensive approach provided the best throughput on our tests, but some economical shared-processor products, like the one from Novell, also moved data very well. Generally, sharing a network adapter noticeably slows throughput.

HOW WE TESTED

The test-bed consisted of a variety of 286- and 386-based computers acting as load stations. They were connected to each access server over null-modem cables.

We ran the Workstation Throughput Evaluation test separately on hardware that varied with the product. Alloy Computer Products' XBUS4/AT (with the PC-Slave/286 cards), Cubix Corp.'s ComBridge, Evergreen Systems' FlexCom, and J&L Information Systems' ChatterBox 4000 used their own CPU cards in their own cabinets. Except for the PC/Slave 286 cards, all these systems used 386- or 386SX-class processors. The products using a shared CPU, Alloy's 386/MultiWare, Novell's Access Server, and Vestra-Subco's LANMaster IncomServ, ran on a Core ATB386 with 8MB of memory, a 386 processor running at 33 MHz, and Core 300MB hard disks. We synchronized each

WHAT THE NUMBERS MEAN

The performance charts convey a great deal of information about the workload capabilities of the access servers we reviewed. J&L's approach with the ChatterBox 4000, using a single processor and network adapter card for each remote client, provides consistently good throughput under a variety of loads. Contention on the network cable and the server limits the product's throughput, but sharing processors or LAN adapters does not.

When it operates with a single client PC, Novell's Access Server offers very good throughput. The Access Server's multitasking architecture slows down performance as the number of stations increases, but even with four busy clients, the throughput is adequate for almost all applications. As we finished our reviews, we also tested a beta version

of the Access Server—Version 1.20—and noticed a marked improvement over the results shown here.

Products that share a single LAN adapter board slow down in performance more markedly because of that sharing. Interestingly, the throughput of Alloy's shared-CPU product, 386/MultiWare, was very similar to the throughput from the same company's individual-CPU product, the combination of the PC-Slave/286 and the XBUS4/AT. This clearly demonstrates how difficult it is to generalize about the comparative performance of shared-CPU products and dedicated-CPU products. The remote-control software, bridge software, and specific hardware elements introduce more variables than the general architecture does.

station with the activity of up to three other stations running the Hard Disk Access Load test to measure how much work the load stations do during the test, as well as the throughput of the single-node performance PC.

We ran all the tests using Novell's NE-2000 Ethernet LAN adapters and a server running NetWare 3.11.

The graphs juxtapose the scores on the Workstation Throughput Evaluation test and the scores on the Hard Disk Access Load test. This clarifies the relationship between the output of the PC running the throughput tests and that of the stations running the load test, as well as the overall work done by the network.

PC Magazine LAN Labs' benchmark tests are written in C and are independent of commercial software. Each load station operates at a rate many times that of a PC, even one in a heavy-use environment.

The Workstation Throughput Evaluation test reports the throughput recorded on a single PC during the performance of a standardized task on the network, and is run in conjunction with the Hard Disk Access Load test. The test program performs a sequential read, a random read, a sequential write, and a random write using a 1MB file. The record size systematically rotates among 16K, 4K, and 512 bytes. The throughput is reported in megabits per second.

The Hard Disk Access Load test reads random blocks of data in 1K increments from a 10K file on the server. The results of this test are reported in requests per second for all the PCs running the load test. The test begins and ends at the same time as the Workstation Throughput Evaluation test.

CONTINUES

80286 processors or one 80386SX 16- or 20-MHz processor. The front panel of the drawer includes a key lock, reset and power switches, and a floppy disk drive. The cabinet on the ComBridge comes prewired to power all 16 modems and conveniently attaches to your phone lines and network cable.

The \$10,640 price of the ComBridge cabinet includes two remote-control 386SX CPU cards and another 386SX card to run the bridge software. As tested,

with four ports equipped with 16-MHz remote-control CPU cards, the ComBridge costs a hefty \$3,357 per port. But if you load up the system with 16 ports (using eight remote-control CPU cards with dual 286 processors), the price comes down to \$1,886 per port. This makes the ComBridge's price per port slightly less than the J&L's ChatterBox 4000, and unlike the ChatterBox 4000, the ComBridge is a complete system with modem power and wiring.

ADDING SPARKLE TO A LAN

The ComBridge includes a remote-control program, *Sparkle*, which allows callers to run programs on the host CPU and see them on their computer. The license for *Sparkle* extends to all workstations and servers on a single network connected by bridges and routers, within one mile of each other. In addition, all remote PCs calling into the network are licensed. But *Sparkle* is not the strongest modem remote-control package we saw.

Imagine getting twice the Bernoulli for two-thirds the price.

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Welcome to the next generation of removable storage, the new Bernoulli® 90 from the leader in removable storage—Iomega®.

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If you need more storage, you'll welcome the Bernoulli 90, since Bernoulli is now comparable in price to a hard disk upgrade. So why not just buy another hard disk? Consider what you *don't* get with a hard disk.

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The new Bernoulli 90 is a welcome relief from pigeonholing technologies. Bernoulli is compatible with every major operating system, as well as workstations. Just take your pick.



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Effective access time: 19 msec
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Disk Specs.

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Shock tolerance: 1,000Gs
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Units Sold.

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Disks: 4,000,000

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So we've prepared a free brochure that you can have by placing a simple phone call. Find out today what a welcome change the new Bernoulli can be. Before the 90s leave you behind.

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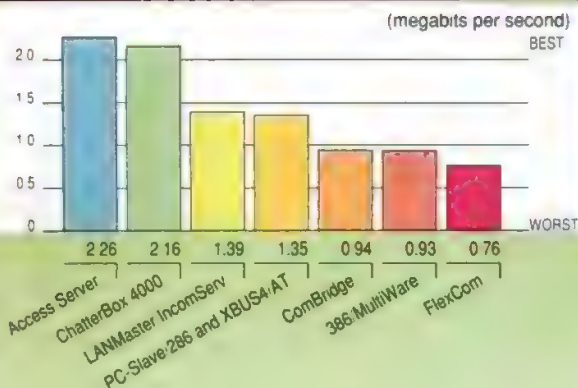
CIRCLE 378 ON READER SERVICE CARD

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BENCHMARK TESTS: ACCESS SERVERS

NO LOAD

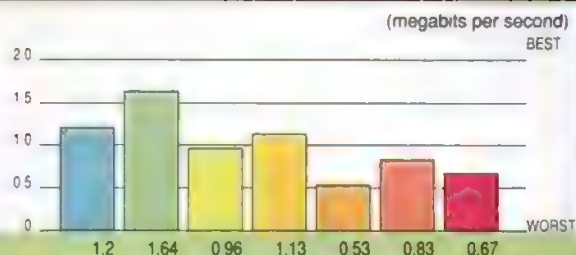
Workstation Throughput Evaluation



Load test not run.

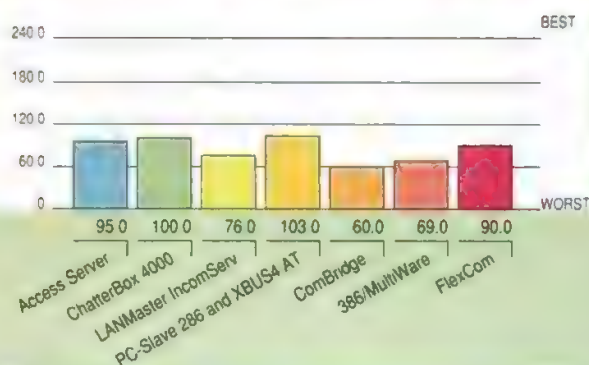
ONE STATION

Workstation Throughput Evaluation *



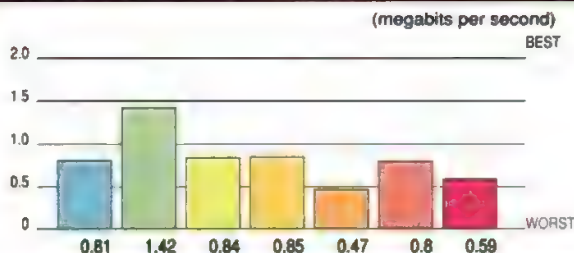
Hard Disk Access Load

(requests per second)



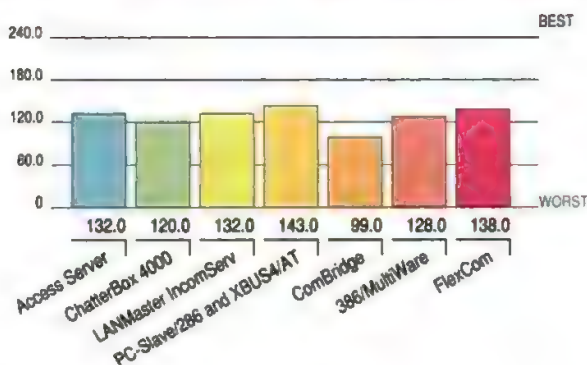
TWO STATIONS

Workstation Throughput Evaluation *



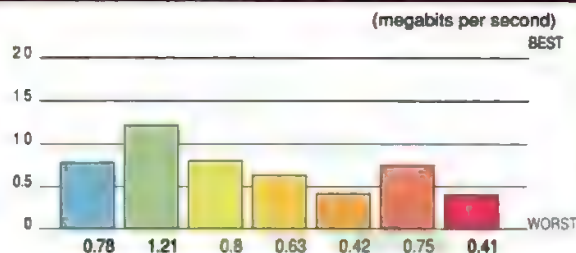
Hard Disk Access Load

(requests per second)



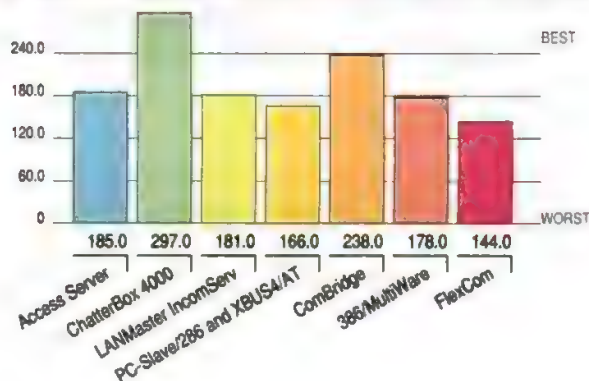
THREE STATIONS

Workstation Throughput Evaluation *



Hard Disk Access Load

(requests per second)



* While the Hard Disk Access Load test is running.

CONNECTIVITY ACCESS SERVERS

(Higher scores represent better performance)

NO LOAD

Workstation
Throughput
Evaluation
(megabits
per second)

Load test
not run.

Access Server	2.26
ChatterBox 4000	2.16
LANMaster	1.39
IncomServ	
PC-Slave 286 and XBUS4/AT	1.35
ComBridge	0.94
386/MultiWare	0.93
FlexCom	0.76

ONE STATION

Workstation
Throughput
Evaluation *
(megabits
per second)

Hard Disk
Access Load
(requests
per second)

Access Server	1.20	95
ChatterBox 4000	1.64	100
LANMaster	0.96	76
IncomServ		
PC-Slave 286 and XBUS4/AT	1.13	103
ComBridge	0.53	60
386/MultiWare	0.83	69
FlexCom	0.67	90

TWO STATIONS

Workstation
Throughput
Evaluation *
(megabits
per second)

Hard Disk
Access Load
(requests
per second)

Access Server	0.81	132
ChatterBox 4000	1.42	120
LANMaster	0.84	132
IncomServ		
PC-Slave 286 and XBUS4/AT	0.85	143
ComBridge	0.47	99
386/MultiWare	0.80	128
FlexCom	0.59	138

THREE STATIONS

Workstation
Throughput
Evaluation *
(megabits
per second)

Hard Disk
Access Load
(requests
per second)

Access Server	0.78	185
ChatterBox 4000	1.21	297
LANMaster	0.80	181
IncomServ		
PC-Slave 286 and XBUS4/AT	0.63	166
ComBridge	0.42	238
386/MultiWare	0.75	178
FlexCom	0.41	144

* While the Hard Disk Access
Load test is running

ENDS

Still, with *Sparkle*, the Cubix ComBridge can act equally well as a modem server. The bundled software offers a modem-sharing solution for communications, using either the INT14 or NASI program interface as appropriate.

Cubix custom-designs and custom-builds its CPU cards, giving them high quality and good performance. The 80386SX processor cards include a serial port with a 16550A UART and room for 4MB of SIMM memory. Each processor has its own VGA circuitry on-board to satisfy software applications that look for the video hardware, but there are no connectors on the remote-control processors for a keyboard or video monitor. The CPU boards are designed solely for remote operation through the serial port, and the video hardware is there only to ensure that picky programs run.

The Cubix CPU cards use a direct network interface between the data bus and the processor, allowing them to communicate with the bridge controller at high speed. But since all the CPU cards share the same network adapter, the network adapter can become a potential bottleneck.

Novell's bridge software has a well-deserved reputation for being tricky to install. It requires you to set many variables, and success usually comes only to the experienced or the very lucky. But Cubix's own installation program eliminates the normal problems and hassles of installing a *NetWare* bridge. This program automates the process of generating the bridge and makes installation comparatively simple. It took our experienced team about 30 minutes to bring up a ComBridge with four active CPUs.

INCLUDES MANAGEMENT SOFTWARE

The ComBridge includes management software that runs on the processor running the bridge software. The management software controls and displays (on the monitor attached to the card running the bridge software) the status of each processor, making it easy to find problems on any cards. The view program displays the operational status of the processors; the reset program can cold-boot a CPU if it is not hung too badly. In addition, the diagnostics program displays network-related data, such as the total number of packets transmitted and received.



FACT FILE

ComBridge

Cubix Corp., 2800 Lockheed Way, Carson City, NV 89706; 800-829-0550, 702-883-7611.

List Price: ComBridge cabinet with two remote-control CPU cards and bridge processor card, \$10,640. Additional 386SX 16-MHz processor cards with 1MB RAM, \$1,395 each; additional 386SX 20-MHz processor cards with 1MB RAM, \$1,645 each. **Requires:** Network adapter, 3MB RAM. DOS 3.3 or later.

In Short: An attractive product with a rather high price tag, the ComBridge is a nicely engineered hardware solution but hampered by below average remote-control software and slow performance. The product also includes management and diagnostic software. Keep in mind that this product is designed to fit in a large computer room, not a small corner of your office.

CIRCLE 405 ON READER SERVICE CARD

Cubix not only offers free, toll-free technical support on weekdays (from 7 A.M. to 9 P.M., P.S.T.), but goes the extra mile and provides support on Saturdays as well, from 9 A.M. to 4 P.M. It also operates a BBS.

The ComBridge does not give you the performance per dollar of some of the other products we tested. It certainly could not come near to matching the performance of the ChatterBox 4000, and in general did not really outstrip even the multitasking systems.

Even so, the ComBridge's substantial and well-engineered appearance gives you the impression of a solid product. With extra facilities like management software, an installation program that eliminates the hassles of getting a *NetWare* bridge up and running, and room for expansion, the ComBridge proves a worthwhile choice.

EVERGREEN SYSTEMS INC.

FlexCom

by M. Keith Thompson

.....

The FlexCom system, completely self-contained in a minitower case that houses the remote-control CPUs and bridge processor, provides good connectivity to *NetWare* LANs. At \$11,175, the FlexCom system includes four 386SX processors running at 16 MHz, a 286 processor run-

ning the bridge software, and a network adapter. It provides both dial-in and dial-out capabilities. Although it's difficult to install and a little costly, the system works well.

Evergreen Systems offers several models of processor cards with FlexCom

to suit a variety of needs. The \$2,295 CPU cards come equipped with four 10-MHz 8086 CPUs and support text-only connections. The \$2,695 CPU cards each contain a 12-MHz 80286 CPU and support EGA,

CGA, and Hercules graphics. The 80386SX-16 processor cards cost \$2,995 and support VGA graphics.

For its remote-control software, Evergreen chose *pcAnywhere IV/LAN*, a program with excellent functionality. Each processor card you buy includes a host

THREE SOLUTIONS FOR REMOTELY CONTROLLING AN OS/2 WORKSTATION: DCAF, PolyMod2, and Remote-OS

by M. Keith Thompson

OS/2 holds some significant advantages over DOS, most notably preemptive multitasking and access to 16MB of RAM. But OS/2's biggest disadvantage is the lack of application software available for it. Nowhere is this more evident than in the remote-control arena.

There are many DOS-based remote-control programs, but only three for OS/2: IBM's *Distributed Console Access Facility* (DCAF), Memsoft's *PolyMod2*, and The Software Lifeline's *Remote-OS*. The OS/2 programs vary widely in their functionality and do not allow the same level of control as their DOS counterparts. Developers of these programs would benefit by studying the DOS equivalents more carefully and adding extra features, such as chat facilities, easier installation programs, and smoother user interfaces.

Most of the OS/2 products we look at here are not offered by vendors as a one-stop-shopping access-server solution. But paired with a multiport serial card, they can use the multitasking features of OS/2 to serve ably in that capacity. And if you own a Micro Channel PS/2 or compatible, you can purchase IBM's DCAF and one of its multiport serial cards for that system. OS/2's true multitasking lets your OS/2 access server do double duty as a client workstation with less chance of crashing than a DOS-based system.

BIG BLUE'S BIG BARGAIN

IBM's *Distributed Console Access Facility* grew out of the need to support multiple platforms from one support



desk. With DCAF, a support person on an OS/2 computer can remotely control both DOS and OS/2 computers on a network. Atypically for IBM, DCAF is a real bargain: \$135 for the server on the network and \$90 for each remote user. The price of DCAF won't keep you awake at night.

DCAF allows one workstation to administer and support networks through the Token-Ring network bridge or across an asynchronous dial-up line, X.25, or SNA WAN backbone. Remotely controlling the keyboard and display of another computer, the workstation can provide training assistance, remote LAN administration, and network management. DCAF's ability to monitor and control both DOS and OS/2 computers makes life easy for network administrators.

The setup and installation are not trivial. DCAF requires OS/2 Extended Edition, IBM's OS/2 package that includes a SQL database and communications enhancements. Configuring OS/2 Extended Edition, the SQL enhancements, and DCAF itself can be time-consuming and difficult on the first

installation; you will probably need help from your dealer. But once installed, DCAF operates simply.

When you run DCAF on a networked OS/2 computer, it controls access to the DOS network workstations. As you might expect, DCAF works only with full-screen OS/2 and character-based DOS applications. Presentation Manager, like Windows, runs extremely slowly and moves a great deal of data through the modems at the server and remote ends. Since all user

names and passwords are preconfigured, the remote computer simply runs the remote end of DCAF and connects through a modem. IBM includes a terminal emulation program that allows a remote user to run programs on the OS/2 computer. Since the terminal program runs only under OS/2, remote users must also have OS/2 installed.

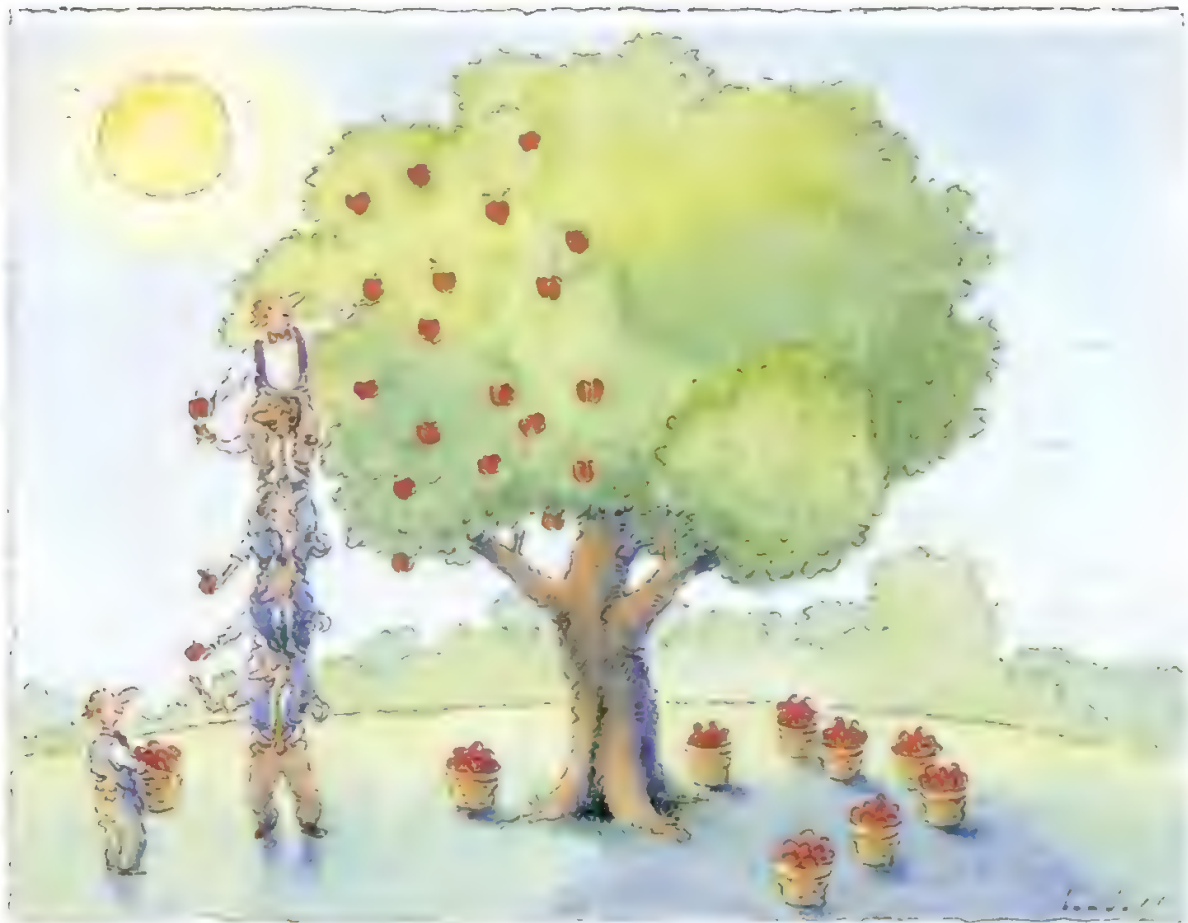
The key to communicating with any computer over the entire network is IBM's LU6.2 protocol. This communications protocol allows application programs to pass information to all computers over any IBM communications link, thus allowing someone to control a DOS computer from an OS/2 workstation through an SNA backbone down to a LAN.

DCAF is a great addition to any True Blue shop. IBM priced the package competitively; its ability to control a DOS computer adds extra value.

A MODERN MULTIUSER ENHANCEMENT

Memsoft designed *PolyMod2* as a multi-user enhancement for OS/2. Combined

CONTINUES



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Diagonal size	17 inches	16 inches
Maximum Display size	300mm x 224mm (HxV)	290mm x 217mm (HxV)
Screen type	Flat face	Round face
Cabinet depth	453mm	475mm
Controls	On/off up front Degauss up front pincusion up front	On/off recessed Degauss in back None
Modes	Supports EGA	None
Retail price	\$1499	\$1499

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why they don't show
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Samsung 17" flat screen SyncMaster 4

NEC 16" round screen Multisync 4D

Unretouched Photography.



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license for the processor, but only two licenses for simultaneous remote users. This could be a problem if you expect that many users on your network will be on the road calling in for short periods of time. An eight-port configuration can easily handle 40 remote users for quick

tasks, but has licenses for only 16 callers. We would rather see the remote software licensed per number of ports on the bridge. Although Evergreen Systems makes other remote call-in licenses avail-

able, none meet this need.

Evergreen offers two models of the FlexCom system. Including the processor card running the bridge software, the Model 100 (which we reviewed) holds six processor cards and the Model 300 houses 15 processor cards. The Model 300, a 19-

THREE SOLUTIONS

CONTINUED

with OS/2's inherent multitasking features, *PolyMod2*'s multiuser capability provides a remote-access solution for OS/2-based computers. At \$645 for 12 users, *PolyMod2* provides remote access for about \$54 per user.

PolyMod2 installs on an OS/2 computer and supports DigiBoards, IBM's ARTIC, and Specialix's serial cards. You connect terminals or modems to the serial ports on the host computer and run a terminal-emulation program from the remote side. If the host computer is on a LAN, you can access it from any workstation on the network.

PolyMod2's multiuser design provides security and ease of use. The system administrator creates menus of programs for each user to run on the host computer. *PolyMod2* answers the call and displays the menu of programs to run.

The terminal-emulation program runs under DOS, *Windows*, and OS/2. The DOS version is a TSR and uses only 40K of RAM, allowing you to run it in the background and access it when necessary. Once connected, you run programs from the menus, but only character-based applications. You cannot start or run programs that are not previously assigned to you, and although you can be assigned more than one program, you can run only one program at a time. While this offers a level of security, it limits your remote-access capability. *PolyMod2* also lacks a file-transfer utility to send and receive files.

PolyMod2 provides limited remote access to an OS/2 computer, but it does not compete with the other products. The lack of a file-transfer utility and the restriction of only one program running on the host limits the program's usefulness. Nevertheless, it is a good if not great multiuser solution.

BUILDING ON A STRONG FOUNDATION

Like *PolyMod2*, The Software Lifeline's *Remote-OS* has roots as a multiuser extension to OS/2, providing a good foundation for remote access. *Remote-OS* offers the most complete remote-access solution of the products in this category. At \$90 for the two-user version and \$500 for the five-user version, *Remote-OS* can handle the needs of a small office and be cost-effective. For large operations, The Software Lifeline offers a \$1,600 33-user version.

Like the other products reviewed here, *Remote-OS* requires some time to set up and configure. *Remote-OS* supports the PS/2's standard eight comm ports and Control Corp.'s line of multiport serial cards. After setup, users can easily call in and run programs. The current release of *Remote-OS* does not include any type of password protection, leaving your system open to anyone with the phone number. The Software Lifeline recognizes this problem and plans a solution in the next release. The new version should be available by the time you read this.

From a DOS computer, you simply run the terminal-emulation program provided and call in to the host. Once the modem answers, an OS/2 prompt greets you, and away you go. Remote users have access to the same resources as the host computer, including network printers and drives. *Remote-OS* includes a simple file-transfer program to allow the remote computer to send and receive files.

Remote-OS offers tremendous flexibility for remote users. Users can start up to eight programs and switch between them by pressing Alt-Esc, OS/2's standard hotkey for switching between sessions. To monitor other modem sessions, *Remote-OS* includes SVIEW.

With SVIEW, you can see the screens of the other users on the host. You can even start Presentation Manager programs from within a full-screen application. But you must be careful about which PM programs you start, since you cannot monitor or control them.

Remote-OS does a good job of providing remote access to an OS/2 workstation. It allows each user eight sessions on the host and handles up to 32 users at a time. Its real weaknesses are an inability to view the host console and a lack of security. Once The Software Lifeline implements effective security features, *Remote-OS* may become the best solution on the market for OS/2 remote access. ■

Distributed Console Access Facility, Version 1.0

IBM Corp. (contact your local IBM dealer); 800-426-2468.

List Price: Initial license, \$135; additional licenses, \$95 each.

Requires: OS/2 Extended Edition workstations, modems.

CIRCLE 399 ON READER SERVICE CARD

PolyMod2, Version 3.11

Memsoft Corp., 1 Park Pl., 621 NW 53rd St., #240, Boca Raton, FL 33487; 407-997-6655.

List Price: \$645; DOS LAN support, \$145. **Requires:** Any OS/2-compatible computer, 2MB RAM on top of OS/2 requirements, OS/2 1.0 or later. NetBIOS and modems recommended.

CIRCLE 400 ON READER SERVICE CARD

Remote-OS, Version 1.02

The Software Lifeline Inc., Fountain Square, 2600 Military Trail, #290, Boca Raton, FL 33431-6358; 407-994-4466.

List Price: 2-user version, \$90; 5-user version, \$500; 9-user version, \$800; 17-user version, \$1,200; 33-user version, \$1,600. **Requires:** Any OS/2-compatible computer, 4MB RAM, OS/2 1.1 or later.

CIRCLE 401 ON READER SERVICE CARD

inch rack-mount unit, is designed for heavy-duty communications environments, but its one network card would still be a bottleneck if you were performing 15 simultaneous high-speed file transfers.

Each processor includes its own serial port. The remote-control CPU cards can communicate only with remote users through serial devices like modems and terminals, and do not have a plug for a monitor or keyboard. They boot from the server as if they were diskless workstations.

NONTRIVIAL INSTALLATION

As with almost any *NetWare* bridge, installation is a nontrivial task requiring time and experience. Evergreen includes all of the necessary disks to get the *NetWare* bridge up and running, and the documentation contains a server worksheet to help you configure and maintain

.

Once installed,

Evergreen Systems'

FlexCom works

transparently.

.

your bridge. But although FlexCom comes with good, well-illustrated documentation, you should still plan to spend at least a few hours with your dealer, even if everything goes well. Once installed, the system works transparently.

You might want to establish a good relationship with your dealer for other reasons. The company offers a less luxurious direct-support plan than the other companies whose products we review here. Support is free, though not toll-free, for only one year, weekdays from 8 to 5, P.S.T. The company also operates a BBS.

The FlexCom system includes software to load your network drivers into high memory if you have the 286 or 386SX processor cards installed. The memory management software leaves about 560K of memory available for your applications when the remote user calls in, enough for most programs.

The host module of *pcAnywhere IV/LAN* loads on the processors at boot time and waits for incoming calls. Once the call

JUST DOWN THE ROAD: Asynchronous Server 64 Promises To Be a Flexible LAN-to-LAN Alternative

by Steve Rigney

One of the most interesting products emerging in the LAN-to-LAN connectivity arena is David Systems' Asynchronous Server 64. Although the product was not available in time for testing for this article, by the time you read this David Systems plans to offer features and add-ons that will make the product function as an asynchronous access server, Ethernet bridge, and IPX router, all with the optional ability to connect to high-speed, 1.544-megabit-per-second T1 circuits. The access-server capabilities of the product are impressive in their power and potential.

The package consists of the ExpressWay WAN Server 64, a multi-tasking operating system, and an AT-bus adapter card containing its own V40 processor and memory. It can handle as many as 31 phone lines. An eight-line installation starts at \$4,245 plus the cost of the PC needed to host the ExpressWay.

Working as an asynchronous access server, the ExpressWay server provides connections to the LAN from the dial-up telephone system or an X.25 public data network. In this setup, the remote PC acts as a true remote client, running IPX remote-shell software to provide full redirection to networked drives.

Typically, the data-transfer rate of such connections proves too slow for interactive computing. When we tried to run our performance tests from the remote client PC, they would not complete in a reasonable period of time because of the overhead involved in moving IPX packets over the slow telephone line. David Systems' developers managed to solve the problem by running LAN remote-control software over the modem link, so that only keystrokes and screens passed over the phone lines. We tested a version of DMA's *pcAnywhere IV/LAN* software

specially configured for the product and found that it performed well. (David Systems however, does not plan to bundle the DMA package with its product.)

The company plans to introduce its ExpressWay IPX Router in July 1991. This internal remote router will move *NetWare* IPX packets between two or more LANs that utilize ExpressWay WAN Server 64s. The ExpressWay IPX Router will be able to connect ARCnet, Ethernet, or Token-Ring *NetWare* LANs.

The ExpressWay Ethernet Bridge application, scheduled for release by David Systems in August 1991, will establish an Ethernet 802.3 media access control-layer (or MAC-layer) bridge between two or more ExpressWay WAN Server 64s. To bridge the two network segments, you will have to equip the WAN Server 64 with either the ExpressWay RS-232 CM or the ExpressWay V.35 CM communications modules.

The T1 option, another promised add-on module, will interest people with a lot of data to move. T1 should provide enough throughput capability for the access-server, bridge, and router options to satisfy the needs of the most data-hungry organizations.

David Systems' Asynchronous Server 64 is not the least expensive way to establish an asynchronous access server, but its growth potential and flexibility make it viable for any organization with growing LAN-to-LAN connectivity needs. ■

Asynchronous Server 64

David Systems Inc., 701 E. Evelyn Ave., Sunnyvale, CA 94088-3718; 800-762-7848, 408-720-6867.

List Price: Eight-line installation, \$4,245. **Requires:** AT-class ISA-bus computer; Ether-T PC-AT adapter; DOS 3.1 or later; *NetWare* 286 or 386, Version 2.1 or later.

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SEPTEMBER 10, 1991 PC MAGAZINE 211A

...For What DOS 5.0 Still Can't Do!

•DOS 5.0 doesn't allow simple, automatic loading of TSR's, device drivers and network software out of conventional memory. 386MAX does.

•DOS 5.0 won't let you use the same chunk of existing memory for either Expanded memory or Extended XMS memory for Windows. 386MAX does.

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Windows Users...

386MAX is the perfect partner for Windows 3.0. Your Windows applications get all the memory your

system has to offer — plus any programs you run out of Windows (straight from DOS) get the Expanded Memory they need! You get the best of both worlds!

If you run pop-up utilities, you can now run them reliably in Windows — thanks to a special feature of 386MAX that allows many TSRs to appear more than once in multiple windows!

Effortless Installation...

"Qualitas has made the installation of the program childishly simple, with sensational results."

Jim Seymour, PC Week

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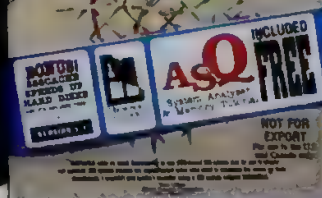
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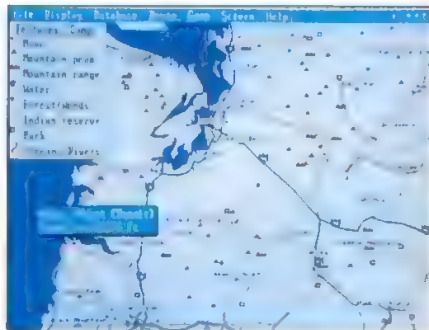
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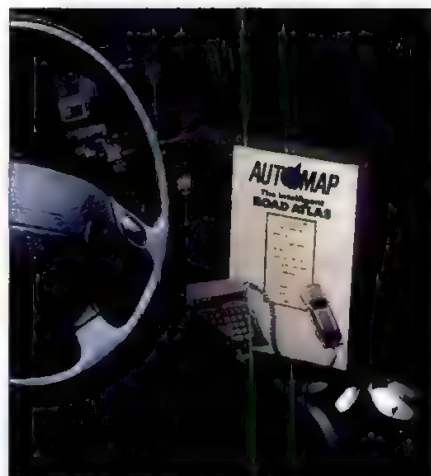


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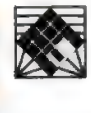
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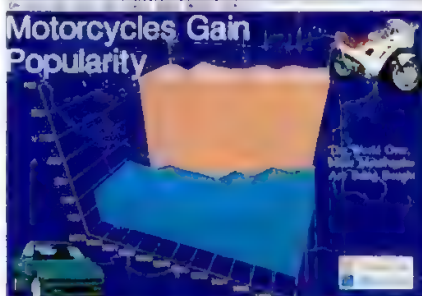
Control Size, Angle, Color, Type and Reproduction Quality.

3-D CHARTS TO-GO allows you to interactively control the size of your charts — so you see the adjustments as you make them! Sizing is as easy as clicking to get the exact size you need. Click again and adjust the viewing distance, click once more and change the rotation angle to add unique perspective to your chart. This rotation-angle control allows enormous flexibility in presenting your charts so that the data is clearly displayed. Quickly select from 17 different chart drawing patterns and 8 foreground and 8 background colors. Want to get crazy? Click to create a host of available special effects on the background and shadows to enhance the three-dimensional effect.

There's more, like the ability to select your choice of chart quality: Draft, Fine Black and White and Fine Color. And 3-D CHARTS TO-GO gives you creative freedom when adding type to your charts. Your chart's title, subtitle, descriptive lines, labels,

legend and footnotes can all be individually sized, colored and employ different fonts.

What makes 3-D CHARTS TO-GO even more impressive (and useful) is its ability to use data from Excel (and many other Windows-based applications). You'll quickly export numbers to 3-D CHARTS TO-GO without exiting Excel. You can easily merge up to 10 individual charts, print them together and perform fast, accurate data comparison. If you're a PageMaker user, you can enhance documents containing financial information and grids following the same simple steps. 3-D CHARTS TO-GO supports .WMF, .PCX and .BMP file formats.

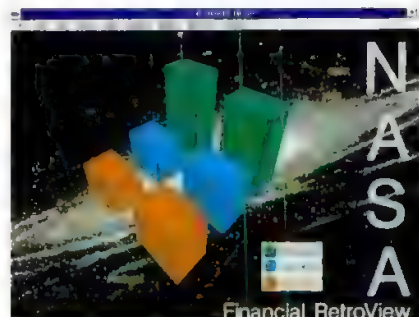


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JUST RELEASED — AMI PRO 2.0!

The Number-One Rated Windows Word Processor. Easier, Faster, More Creative.

Ami Pro has created a world of possibilities for the printed page. It is a pure Windows product, not a "ported" DOS counterpart. It features the visual power and easy-to-use nature of Windows 3.0 to produce top-notch results. Indeed, it established a new standard in word processing for the graphical user interface. Now, version 2.0 breaks new ground with a rich visual environment along with an amazing array of easy-to-use tools at your fingertips. You'll write and format sophisticated documents you may have never attempted before because Ami Pro 2.0 is designed to work like you do, associating pictures and symbols—with concepts. Your ideas take shape faster and expressing them becomes easier. That's the key: Ami Pro 2.0 is extremely easy to use. So easy to use in fact, that you can create crisp, professional-looking letters, reports, proposals and presentations the very first time you use it—even if you've never used a word processor before!

An Ideal Writing Environment. Fast, Smart — and Visual.

Ami Pro 2.0 features fast outlining, easy revision marking, mathematical equations and even free-hand drawing. You'll put together charts and tables with simple point-and-shoot action. You'll see your work with true WYSIWYG display. You'll enjoy the built-in portfolio of style sheets and graphics-manipulation tools. Simply choose from pull-down menus to generate a table of contents, flow text around graphics, change fonts, colors and more. You'll select typefaces and move elements on the page easier than you ever thought possible. Ami Pro 2.0 gives you the best spell checker in the business, a thesaurus with 1.4 million selections, a full macro

language, an interactive ruler, status bar, color palette and much more. More than Word For Windows. More than WordPerfect.

Power Under the Hood!

Although Ami Pro 2.0 is a breeze to use (and use to its fullest), it possesses enormous power under its sleek interface. You'll seamlessly import and export files from WordPerfect, Microsoft Word, MultiMate, DCA, DisplayWrite, WordStar and others. Ami Pro 2.0 contains over 120 one-click SmartIcons (which match those found in Lotus 1-2-3 for Windows) that make moving through Ami Pro 2.0 fun, and you can customize and arrange them any way you like.

Open and edit multiple documents at one time, see them in four editable view levels — all WYSIWYG and instantly "hot-link" to other Windows applications, including Lotus 1-2-3, with 2-way Dynamic Data Exchange (DDE).

Power Fields.

You can actually create documents automatically using this innovative technological feat. Power Fields are embedded commands that, typed directly into a document, enable it to perform a task automatically. For example, a business letter can request the input of a name, look up the address from another file, automatically place the name and address on the page in a pre-defined format and include various paragraphs or passages depending on the data provided. A power field could also be used to check the state or zip code in the address and determine whether a local or toll-free phone number should be included in the body of the letter.

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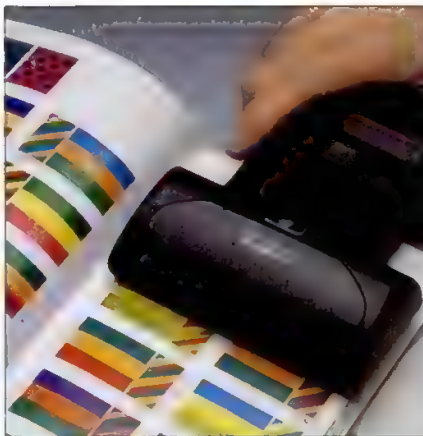
Imagine an instrument that you can quickly pass over a graphic image, logo, design, drawing, chart, photograph — and instantly capture it to your computer screen. Brilliant colors and unmatched resolution can be yours with the Marstek family of scanners.

The new M-6000CG Super Color scanner absorbs an astonishing 262,144 different colors from any printed page or photo! Scan in your photo albums, your wedding picture, or your graduation photo and display it onscreen with lifelike realism. Produce high-impact documents and presentations with the power of graphic images. The possibilities are limitless. The M-6000CG also scans in true 64 gray scales with 400 dpi. In color mode, the M-6000CG scans in 200 dpi. (200 dpi is just right for photos and artwork. Picture this: If you have a standard VGA monitor and scan in a 3" wide photo — it fills your entire screen with a perfectly duplicated image.)

For precise scanning of anything small, you need the M800 — delivering an incredible, unmatched 800 dots per inch. 800 dpi means crisper, cleaner, more highly detailed images for use in desktop published documents, reports, proposals, newsletters, flyers, and brochures. Scan in a postage stamp and it fills the screen with stunning detail.

And with a host of special effects and patterns built right in, controlling the look of the image is simple — and fun! The images you scan will reproduce as if they were originals, and they can be stored in TIF, PIX, PCX, CUT, IMG and MSP formats.

Or imagine simply scanning text from printed pages, magazines and books — no more re-keying! The Marstek hand scanners deliver unmatched reso-



lution for precise character recognition regardless of the type style or size and even include free optical character recognition (OCR) software to turn the scanned text into ASCII — ready to use in word processing or desktop publishing applications.

And the whole system is ready to run right out of the box. The installation is fast and easy, the technology is simply amazing.

The Marstek Family Of Mice.

The Marstek Mice are designed for higher performance. They're 100% Microsoft compatible and impeccably accurate — but they come with a surprisingly modest price tag. We tested the Marstek Mice (E22 and P93 models) for accuracy and speed against other leading nameplates, and it equalled or outperformed the Microsoft Mouse, Logitech's

Series 9, and several others. The secret is in the outer shell design and durable construction. You'll notice a silkier movement and an increased feeling of control the very first time you use it. The Marstek E22 and P93 also feature buttons with firm, clean clicks. A far cry from the "mushy" buttons you find on other mice, great for fast, rapid-fire computing.

BONUS!

Free When You Buy A Marstek Hand Scanner.

Marstek CAT Reader or Perceive Personal/DOS OCR Software — These packages allow fast, easy optical character reading (OCR) for text pages. Imagine having the ability to simply SCAN text — instead of re-keying it! You'll improve efficiency for a variety of office tasks.

PC Paintbrush Plus or Rainbow Paint — the industry's most respected and capable paint programs — put the most extensive electronic palette at your fingertips — colors, image blending and more.



Marstek Scanner/Mice

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How Do You Fill In Pre-Printed Forms?

Are you still filling in insurance forms, legal and tax forms, government forms, invoices, medical and Federal Express forms by hand? Or struggling through the trial-and-error nightmare of using a typewriter? The fact is, filling in pre-printed forms is a classic example of inefficiency, with a high margin for error. The PC can be a great assistant in filling in forms, and FormFiller 3.0 is the premier forms fill-in software for even the most complex multi-page, multi-part, and double-sided forms.

FormFiller 3.0 actually synchronizes your computer printer (a critical first step), to locate blanks and place information on the form with pinpoint-precise accuracy, and it works with virtually any dot-matrix, daisywheel or laser printer.

This powerful software streamlines data entry with a host of on-screen guides and error-checking features. These features not only speed the process, but virtually eliminate errors as well — errors that can be very costly. Along with FormFiller 3.0's extensive data validation features there's plenty of context-sensitive help available for any function.

With FormFiller 3.0, you can decide the order in which the blanks should be filled in, give certain areas color codes for fast visual recognition, include non-printable notes to instruct data entry, "lock" certain information into the form so it won't have to be manually entered each time the form is filled out. You can also quickly set up FormFiller 3.0 to import and automatically fill-in forms directly from your database, and "batch print" your forms.

The system doesn't stop there. It contains a complete set of financial and mathematical functions that you can easily assign to particular blanks to perform a specific calculation whenever value is entered. Or you can automatically perform a series of

calculations on a series of numbers. For example, you could quickly instruct FormFiller 3.0 to calculate the extended prices of all items listed on an invoice, total them, deduct a discount, figure and deduct taxes and calculate the final total. There are over 40 math functions in all, including amortization, interest, present and future values, depreciation, percentages — dozens of others!

There's more! FormFiller 3.0 includes a unique "Look-up" feature that stores pieces of information and automatically places them into position with just a menu selection. Part numbers, shipping and billing addresses, names, phone numbers, account numbers, payment terms and hundreds of other details can be organized and stored and retrieved anytime — without looking for them or retyping them. In addition, FormFiller 3.0 allows you to control exactly HOW the data is to appear and be printed. For example, negative numbers can be entered and automatically appear and print in parentheses. Enter a series of 10 digits into a specific field and FormFiller 3.0 displays them as an area code and telephone number, or make the data entered into certain spaces on the form automatically print bold.

This all means that a form that may have taken fifteen or twenty minutes to fully complete (possibly containing errors), now may require as little as one minute to fully complete, including a check for errors and omissions.

BONUS!

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Quick Template is the perfect replacement for your lost plastic templates. Pop up a list of every special key from within FormFiller. A \$49.95 value!



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IBM PC, XT, AT, PS/2 or compatibles with 512K, DOS 2.0 or greater and one floppy drive and a hard disk. Supports virtually all printers. Includes "The FormFiller Sampler" — sample templates, user guide and help cards.

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By simply typing answers to questions on your screen, Personal Law Firm actually "writes" binding legal documents customized to your specific situation and ready to sign. From wills to maintenance agreements; work for hire agreements to warranty documents; promissory notes and commercial leases to demand letters, Personal Law Firm gets your agreements in writing fast.

With over 500 pages of concise, informative documentation and reference, Personal Law Firm is the most comprehensive legal package available today. Just select the type of document from the Main Menu. There's plenty of background material about each document you prepare, along with explanations of the applicable laws that govern them.

The Importance Of A Will.

It's a nightmare you hope never happens. An untimely accident or illness leaves your family without a breadwinner — and without a will. In such cases,

the state immediately moves in to divide your estate as it sees fit, with no regard for your wishes. Your survivors will face a long, uphill battle to reclaim what a will would have granted them instantly upon your death, without question.

Yet, 3 out of 4 people every year die without one.

Perhaps you feel that in the event of an illness or accident that leaves you completely dependent on life support, it should not be prolonged. You can create a Living Will to state in writing your wishes under specific circumstances.

Personal Law Firm covers virtually any everyday personal or business legal situation. For example, a restaurant owner from Chicago recently wrote us to relate this situation: A customer raved about his family

recipe "Sauce Katrina" served at his restaurant, and asked for the recipe. Several months later, the restaurant's chef ran across "Sauce Katrina" bottled and for sale at the local epicurian shop with a label bearing the exact ingredients and the customer's name. A demand letter went out the next day from the restaurant owner to the customer asking sales of the sauce be stopped. The customer agreed. With no legal fees and no further misunderstanding.

To protect yourself against these unforeseen problems, you must get all agreements you enter into in writing. Personal Law Firm is the fastest, most inexpensive way to provide that protection.

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| Marital Settlement Agreements | Software Escrow Agreement |
| Child Guardianship Consent Form | Letter of Offer to Purchase |
| Commercial Real Estate Lease | Demand Letter |
| Work for Hire Agreement | Rejection of Goods Letter |
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| Personal Guarantee | Notice of Contract Breach |
| | Notice of Contract Assignment |

Personal Law Firm

ZQ1050 Law Firm 5¼" & 3¼" \$99.95
System Requirements: IBM PC, XT, AT, PS/2 and compatibles with 256K, one floppy, a hard disk and DOS 2.1 or greater. It requires an 80-character display (color or monochrome) and will support virtually any printer.



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SEPTEMBER 10, 1991 PC MAGAZINE 211G

Dear Tiger Reader:

I remember the first time I met the group from TigerSoftware. Their goal was to create an alternative software source. A source that would provide more in-depth information about the software they sold, and place a high priority on skilled customer service.

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That's why I strongly suggest you take a good look at this important industry marketing.

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Avoid Hard Disk "Heart Attack."

Fragmentation is Inevitable And Fatal!

When your hard disk was new, it ran lean and swift, retrieving files in just a few seconds. But as you added programs and files, your hard disk became fat and sluggish. The fact is a fragmented, "dirty" hard disk can take up to 100 seconds to retrieve a file that used to take 10 seconds — **that's 10 times slower!**

The problem? Fragmentation kills hard disk performance. It causes excessive head movement across the media, creating bad spots throughout the drive. It's aggravating and dangerous! A fragmented hard disk, left unmaintained, is almost certain to

crash. That means major data loss. Disk Optimizer 4.0's sleek, *easy-to-use menu system* makes hard disk maintenance simple.

Why Optimize?

Simply everyone who owns a hard disk, and relies on the speed and convenience it gives them. But unfortunately, DOS is doing its best to slow hard disks — by breaking files up into pieces. Storing different chunks in different places. As a result, loading is slower. Sorting is slower. Everything takes longer because your hard disk has to chase around picking up and laying down pieces of your file.

After un-fragmenting with Disk Optimizer, a file that once occupied 20 different sectors in 20 different locations is now in one contiguous piece. The next time your drive reads it, there's just one place it has to look.

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Make Your PC Run up to 60 Times Faster!

Unleash Your System's Hidden Potential for Blistering Speed!

Trapped deep within the architecture of your computer lies an enormous untapped potential for speed. Unfortunately, this vast resource has been neglected because no one could devise a way to unleash it. Until now.

FAST! is the brilliant caching system that actually increases the speed of your computer by up to 60 times! Simple to install, a snap to use, this software solution can make a stock XT outrun a full-blown 386! In tests, we loaded a 386 with FAST! and we almost blew the doors off the lab!

How Can It Be Possible?

How can a software package have such a shattering impact on my computer? Although the authors are keeping the secret to themselves, they have shared information about where the slowdowns are within your system, where the speed is trapped and what has to be done to harness it.

They do tell us specifically, that the biggest system slowdown for your system is waiting for disk reads. When you use an application, you use it in "chunks" of various sizes, depending on the functions you are performing. Sure, you load it all at once, but it's used in bits and pieces. Your system must read back and forth, searching for these chunks of programs as they are needed by the application.

A Perfectly Logical Solution...

One of the keys to the FAST! design is the addition of "intuitive logic" to the technique of caching, so your system actually anticipates what your CPU will be seeking and reads the information directly

from the hard disk (or floppy) into a special buffer created within your RAM. This information is, in reality, retrieved before the system asks for it!

As a result, your CPU simply spends no time waiting for disk reads, so processing can be done as fast as the system is capable — faster than you've ever seen it! The more disk-intensive the application is, the more dramatic the increase in speed can be achieved using FAST! Database, spreadsheet and complex CAD systems, word processing, data transfer and more will achieve maximum response with FAST!

FAST! is also good for your system. By reducing the chaotic searches for data on your hard disk, it actually extends its life, reducing the damaging effects of constant wear. It's good for your software applications because they'll run leaner and faster, so you'll be more productive.

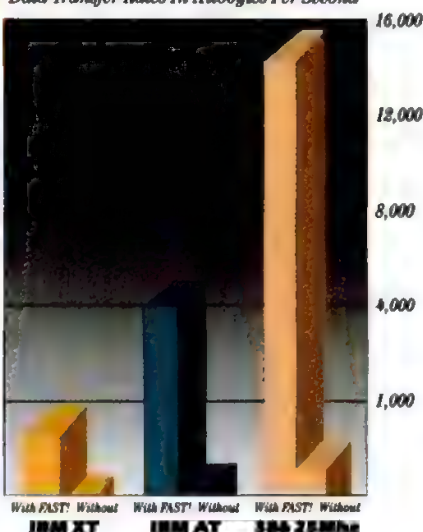
FAST! Under Windows 3.0!

Charles Berman, author of The Windows 3.0 Comparison, wrote "One solution (to the speed problem) is to replace Windows' disk cache, SMARTDRV.SYS, with another cache. One such program, FAST!, has made my recent Windows life a lot easier. FAST! makes everything appear faster."

On a standard Drive Evaluation Comparison test, FAST! increased performance over 1700% — and 550% over Windows' caching software!

With FAST! vs. Without FAST!

Data Transfer Rates In Kilobytes Per Second



With FAST! Without FAST!

With FAST! Without FAST!



FAST!

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FAST! will run on the IBM PC, XT, AT, PS-2 and compatibles with 128K RAM and DOS 2.1 or greater. Supports fixed or floppy disk systems, and supports conventional, expanded or extended memory.	

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CIRCLE 380 ON READER SERVICE CARD

SEPTEMBER 10, 1991 PC MAGAZINE 211



Evergreen's \$11,175 FlexCom comes in a self-contained mini-tower case that can hold six cards, including the 16-MHz 386SX CPU cards, bridge processor, and network adapter. Evergreen also offers a larger rack-mount unit that houses 15 cards.

is established, *pcAnywhere IV/LAN* prompts you for your log-on name and password, then logs you on. At this point, you have complete access to the network.

On their remote computers, callers use *pcAnywhere IV/LAN*'s AWTERM program to dial in to the LAN. This program comes complete with file-transfer capability. (For a complete review of *pcAnywhere IV/LAN*, see "Reaching Out With LAN Remote-Control Software," July 1991.)

ADMINISTRATION UTILITIES

In addition to *pcAnywhere IV/LAN*, the FlexCom package includes a couple of useful utilities. The CPCON program allows authorized users to monitor, control, and configure each communications port

CONNECTIVITY ACCESS SERVERS

from any workstation on the network. Since CPCON uses an interface similar to that of *NetWare* utilities, LAN managers will quickly feel comfortable using it. The program checks the status of the lines, monitors the bridge processor's screen, operates the processor's keyboard, resets the processor, and configures the ports.

Since processors can hang, FlexCom also includes a program to poll the processors periodically. CPAUDIT provides this watchdog facility, automatically resetting a processor if it does not respond. The system administrator sets the interval to poll the processors.

As an extra feature, the FlexCom system also includes a NASI driver for dial-out communications. This driver allows users on the network to employ any communications program that supports NASI redirection to call out over the network on shared modems. Evergreen also includes a basic terminal-emulation program for users who lack the required terminal software.

Our performance tests show the FlexCom system to be somewhat on the slow side, nearly in line with Cubix's ComBridge. That's not surprising when you consider that Evergreen uses Cubix processor cards in the FlexCom. The processors service the ports adequately; a potential bottleneck comes from one network adapter card being used for all of the processors.

The FlexCom system rates as a fairly expensive solution at \$2,794 per port, but it includes various programs that enhance its performance and provides a solid platform for remote access and communications services.

J&L INFORMATION SYSTEMS INC.

ChatterBox 4000

by M. Keith Thompson

J&L Information Systems makes communications servers for PC-based LANs running any type of network software. The products in the ChatterBox series—the ChatterBox 4000, 6000, and 9000—are the latest members of the family. They share several traits: They use a multiple-CPU architecture, they attach to the network as diskless workstations, and they provide an excellent remote-access solution. The model we

tested, the ChatterBox 4000, houses four 80386SX 16-MHz CPU cards. It offers reliability and simple installation in a complete package for \$8,280, or \$2,070 per port.

The \$3,195 base model of the ChatterBox 4000 comes with only one CPU card; each additional card costs \$1,695. While this is not as cheap as multitasking access-server products, J&L's system provides throughput, reliability, and flexibility that neither the multitasking products nor the other multi-CPU products can match. With the ChatterBox 4000, there's no need to attach to any PC at all.

J&L OEMs the *ColSession* remote-control program to allow callers to run programs on the LAN. (At press time, J&L announced that it would begin shipping *pcAnywhere/IV* with the ChatterBox.) Running *ColSession* on each CPU, the ChatterBox can handle up to four callers at once. The *ColSession* license allows you to make an unlimited number of copies of the software expressly for calling the ChatterBox.

The ChatterBox 4000 uses a 20-slot passive backplane divided into four user



J&L's \$3,195 ChatterBox 4000 comes in a tower-style case slightly larger than an IBM PS/2 Model 80. It holds four 386SX CPU cards with on-board video; LEDs indicate the status of each processor. Each CPU card is paired with its own LAN adapter. Inside, the ChatterBox has room for six half-height devices.



FACT FILE

FlexCom

Evergreen Systems Inc., 120 Landing Ct., Suite A, Novato, CA 94945; 415-897-8888.
List Price: \$11,175.

Requires: 2MB RAM, DOS 3.3 or later.

In Short: The FlexCom system gives users an all-in-one solution for their dial-in and dial-out communications, but at a fairly high price. Although installation is not easy and requires time, the FlexCom works reliably if slowly once it is up. Considering that it uses the Cubix processor cards, its slower performance is not surprising.

FACT FILE

EDITORS' CHOICE

ChatterBox 4000

J&L Information Systems Inc., 9238 Deering Ave., Chatsworth, CA 91311; 818-709-1778. **List Price:** ChatterBox 4000 (4-user system), \$3,195; ChatterBox 6000 (6-user system), \$3,295; ChatterBox 9000 (9-user system), \$3,595; NRS (up to 70 users), \$5,995; each system includes one 16-MHz 386SX VGA CPU with 1MB. Additional 16-MHz 386SX VGA CPUs, \$1,695 each.

Requires: Network adapter.

In Short: A well-designed multi-CPU system able to handle incoming and outgoing calls under any LAN operating system, the ChatterBox 4000 provides highly reliable hardware reset features, easy installation, and great flexibility. The product provided the best performance on our benchmark tests of all the systems we reviewed. The manufacturer's many years in the communications server market are readily apparent in this excellent access-server solution.

CIRCLE 497 ON READER SERVICE CARD

clusters of five slots. All 20 slots share power connections and a few specific

signaling connections, but keep their data-processing leads segregated within each five-slot cluster. Each five-slot group includes a CPU card with on-board video and a separate LAN adapter card. This is the only multiple-CPU product we reviewed that includes connectors for a monitor and keyboard on each remote-control CPU card. Each group leaves enough slots for other cards, allowing you to add a separate modem card, or a SCSI adapter if you want to install a CD-ROM drive or tape backup cartridge.

The six-user ChatterBox 6000 includes one five-slot cluster and five three-slot clusters, while the nine-user ChatterBox 9000 includes nine two-slot clusters. Since you do not need constant access to a screen or keyboard for each processor, J&L offers a keyboard and monitor switch box for \$195.

Another product in the J&L line is the Network Resource System (NRS), which we did not review. The design is a variation on ChatterBox's divided-backplane principle; all the equipment fits in a 19-

inch rack-mount system. The processor cards for the NRS include the modular design of their ChatterBox siblings, but you can also plug and unplug the processors while the system's power is on. This allows the processors to continue to handle calls while you service the units. Since the NRS has no expansion slots, each CPU card includes two short slots for a network adapter and one other short card. The NRS for up to 70 users sells for \$5,995.

STORAGE INSIDE

The tower-style case of the ChatterBox is somewhat larger than an IBM PS/2 Model 80 and houses up to six half-height devices; this is quite enough for the ChatterBox 4000 and 6000 models, although users of the ChatterBox 9000 system may initially find this limited. But since most installations typically boot each CPU in the ChatterBox as a diskless workstation, what might seem like a limitation on the number of drive bays actually turns out to be unimportant.

The front panel includes a reset button for each processor. Although they are conveniently located at the front, the reset switches are embedded just deep enough

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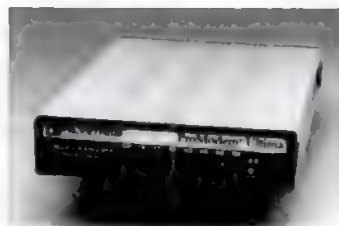
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in the panel that you do not have to worry about hitting them accidentally. LEDs connected to the RS-232 lines show the status of each processor's serial port.

The CPU cards for the ChatterBox are unique and specific to the product; you cannot run them in a PC as you can with the Alloy and Cubix CPU cards. Each processor card comes in a modular design in order to facilitate custom CPU and video-display choices. The base processing card is better-stocked than any of the others we saw: It consists of a 16550-controlled serial port, a floppy disk controller, and an IDE hard disk interface. The two plug-in daughterboard options are the video (VGA or CGA/Mono) module and the choice of a 386SX, 386, or 486 processor module.

Each CPU in the ChatterBox runs independently with its own LAN adapter. The ChatterBox CPUs work with literally any LAN software. Since the CPUs do not interact, except across the network, you do not have to configure special bridge software, create special drivers, or dedicate a CPU to running the bridge software, as you do with the Alloy and Cubix multi-CPU products.

ENSURING RELIABLE CONNECTIONS

J&L includes two extremely useful features to ensure reliable connections. Even though *Co/Session* is well-behaved, it cannot control what the application does

.....
**Each CPU in the
ChatterBox runs
independently with its
own LAN adapter.**
.....

to the host computer's memory. Sometimes computers lock up, and when the computer is an access server, outside users cannot get in.

To solve this problem, each CPU card in the ChatterBox includes a hardware reset switch attached to COM1, allowing the CPU card to reset itself when it loses the modem carrier. This welcome tech-

nique assures that each CPU will be ready to answer incoming calls regardless of what happened during the previous remote-processing session.

J&L also includes a circuit to make the phone line busy while the computer is resetting after a call. This little trick keeps a call from coming into a computer that is not ready to accept it. More importantly, it avoids the possibility of an incoming call attaching to a malfunctioning processor. If a processing unit is unable to complete the boot cycle, its phone line remains out of service. With these two safety features, the ChatterBox provides around-the-clock unattended uptime for your communication servers.

The ChatterBox also includes status and diagnostic LEDs. These LEDs display the various states of each processor. A quick glance at the box lets you know whether everything is operating as it should be. Unlike the bridge products, which require special software to allow you to measure the status of the processors, you can run any remote-control program across the LAN to monitor and administer each ChatterBox CPU because each CPU is also a PC.

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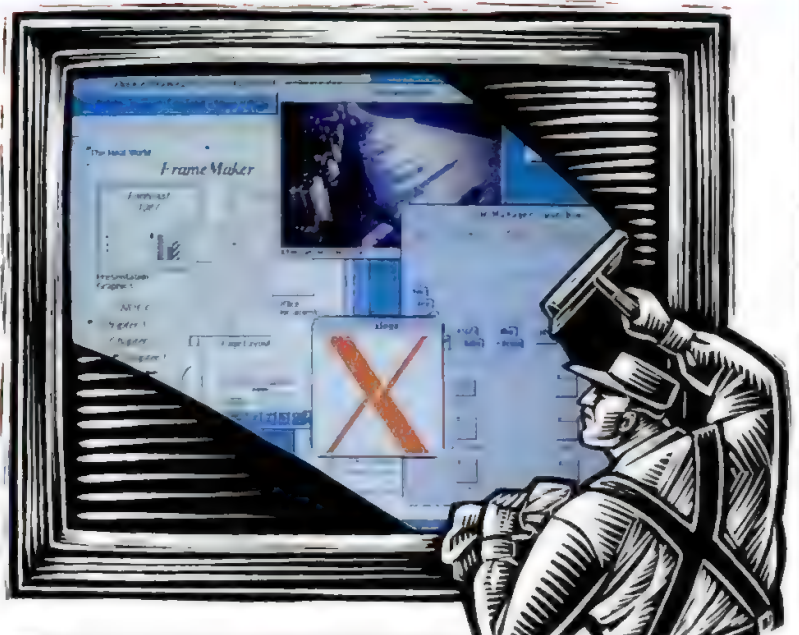
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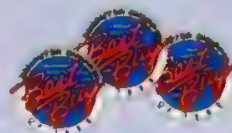


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CHATTERBOX PROGRAMS

Operating *Co/Session* is simple. The *SUP-PORT* program runs on the remote PC and calls the *SAPPLICA* program running on the host PC. You put the *SAPPLICA* program in the *SYS:LOGIN* directory of the server and run it before you run the *LOGIN* program. After you dial in, you simply log on and use the computer as if you were sitting on the network. Once you are connected and running, you can transfer files with simple menus.

A combination of programs included with the ChatterBox allows you to use the modems for dialing out if they are not currently handling a call. *X-Host* runs on the ChatterBox processor and communicates with *Co/Session*, relaying the current status of the comm port. *X-Serve* runs on your workstation and queries the network for available ChatterBox processors. Once it finds a processor, *X-Serve* takes control of it and effectively connects your screen and keyboard to it.

The ChatterBox 4000 we tested included four 386SX processors with 2MB of RAM each. It emerged the top performer in all of our tests because no part of the system, except the cabinet and power

CONNECTIVITY ACCESS SERVERS

supply, is shared among the remote users. Each caller gets a dedicated high-speed CPU and LAN adapter, so there are no bottlenecks.

The ChatterBox series of asynchronous communications servers provides solutions for many different problems. Their flexibility and multiple-CPU design make them easy to use and support. Their other functions include X.25 gateways, LAN and WAN bridges, and e-mail servers. Clever software design allows you to configure your processors to perform dial-in, dial-out, or both on demand.

J&L's unlimited support for the ChatterBox is free, although not toll free, from 7:30 to 5:30, P.S.T. The company also operates a BBS for its users.

The ChatterBox works well in diverse environments. Its multiple-CPU design allows maximum flexibility and fast throughput. J&L has been in the communications server market since its inception, and it shows in the way the company provides real solutions for real-world problems.

NOVELL INC.

Access Server

by M. Keith Thompson

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Novell's Access Server provides users with flexible dial-in access to a *NetWare* LAN in a shared-CPU architecture. As remote users call in, they control sessions on a time-sliced 80386 or 80486 processor running under Quarterdeck Office Systems' *DESQview 386*. Priced at \$1,995, the product offers a shared-CPU approach that has a cost advantage over competing separate-CPU systems. By itself, the system costs about \$500 per port. If you use a \$4,000 PC as an access server, it costs approximately \$1,500 per port for a four-port system, not including the modem.

The Access Server package consists of a WNIM (Wide-area Network Interface Module) intelligent four-port serial card using a V80 processor, a special version of Novell's IPX transport-layer software, and *DESQview 386*. Novell also OEMs a version of DMA's *pcAnywhere* modem remote-control program (Novell calls its version *OnLAN/PC*). You provide a single

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FACT FILE

Access Server

Novell Inc., Communications Products Division, 890 Ross Dr., Sunnyvale, CA 94089; 800-453-1267, 408-747-4000
List Price: \$1,995.

Requires: For server: i386/i486 processor, NetWare 2.1x or later, 1MB conventional RAM, 850K extended RAM per session, high-density floppy disk drive. For workstation 512K RAM, floppy disk drive.

In Short: In usual Novell fashion, sound performance makes the Access Server a good solution for networks with a 24-hour administrator. It also works nicely for up to four 9,600-bps connections.

CIRCLE 408 ON READER SERVICE CARD

LAN adapter card and a single video adapter to go with the system. The package works on NetWare, Version 2.1 and later, and provides reasonable throughput for three to five simultaneous users. You can install the package on any 386 or 486 ISA-bus PC with at least 4MB of RAM, but you might need a few more megabytes to create more simultaneous sessions.

The Access Server includes a multiplexing IPX program that allows multiple log-ons for a single network adapter address. The standard version of IPX allows only one user to be logged in at a time, which means that if a new user logs on, the previously logged-on users lose their identities and become the new user.

A beta version of the Access Server—Version 1.20—arrived just as we finished our reviews. The benchmark test results for this product (which we do not print here) show a marked improvement over the original. Version 1.20 supports IBM's ARTIC (A Real-Time Interface Coprocessor) card, so it will handle faster modem connections. Novell has also announced support for other multiport serial cards, including DigiBoard and Specialix.

Novell went to great effort to make Version 1.20's installation program much easier to use. Installation is down from roughly 2 hours to 30 minutes. But if you do not place all the drivers in the proper directory structure, you'll get a headache.

As for the version we reviewed, its installation is long but straightforward and well-documented. Since the computer must be a dedicated server, finding a 64K location in high memory and an I/O ad-

CONNECTIVITY

ACCESS SERVERS

dress for the WNIM card should be easy.

Installing *DESQview* and *OnLAN/PC* is accomplished via Novell's menu-driven install program. Then you copy a few files to the SYS:PUBLIC directory and mark them as sharable and read only (SRO).

Novell chose a reliable, proven technology by selecting *DESQview* 386. Using *DESQview* on a system with an i386/i486

processor, you can allow one computer, with multiple intelligent serial cards, to handle concurrent phone calls. The limit on the number of sessions depends on the speed of the computer acting as the server, the amount of memory installed on it, and what programs each dial-in user will run.

DESQview 386 uses the Virtual 86 mode of the i386/i486 CPU and devotes the equivalent of an 8086 to each DOS session. Each session can have up to 550K

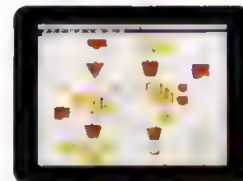
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of RAM and still support VGA graphics. But since VGA graphics screen updates can run slowly over a remote connection, a better option is to run applications in character mode. Because of the way *DESQview*'s memory manager *QEMM* works, this leaves 680K of RAM for programs. But either configuration leaves plenty of RAM to run any program you could run on the LAN. (For a review of *DESQview 386*, see "386 Multitasking Environments: Making DOS Work Overtime," *PC Magazine*, October 16, 1990.)

The Access Server permits full remote control of the network by running *OnLAN/PC* in each *DESQview* session. When you call the Access Server, *OnLAN/PC* answers the line and asks for your user name and password. For extra security, *OnLAN/PC* provides a dial-back feature. As the name implies, after the user logs on, the host hangs up and calls a predefined phone number for this person.

Novell provides easy-to-use administrative tools for its Access Server system. The Access Information menu allows entry into screens of informative data. With proper authorization, you can see an audit log, port configurations and status, and

CONNECTIVITY ACCESS SERVERS



Novell's Access Server (\$1,995) employs an intelligent four-port serial card that you install inside a 386- or 486-based PC. By using remote software and a proprietary multiplexing IPX program, the Access Server allows remote users to dial in to the modems you attach to the serial card.

session status. The session status window shows the date and time a user connected, the attached server, the user's log-in name, and the answering port. To avoid managing two databases of users and passwords, *OnLAN/PC* uses the *NetWare* bindery, a

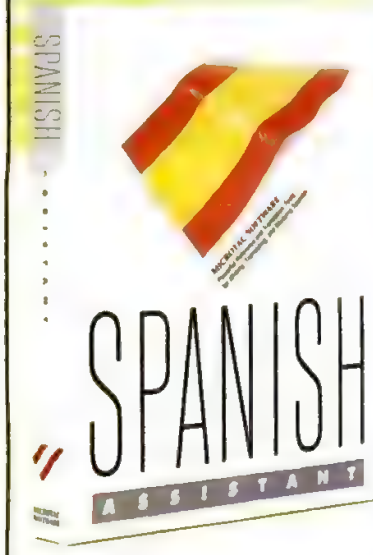
database of user names and privileges kept by *NetWare*.

PROS AND CONS

The Access Server has two disadvantages: Although it did well on our benchmark tests, even under a three-station load, it has limited throughput for many more simultaneous users beyond that, and difficulty in resetting a session. A single shared 33-MHz 386 processor will have difficulty keeping up with more than four high-speed, 9,600-bit-per-second connections. The dedicated CPU techniques used by J&L and Cubix offer more throughput per session, but at a higher cost.

The Access Server also gives you no way to reset a session remotely if a program or action causes it to hang. Despite *DESQview*'s excellent multitasking environment, it's possible for a session to die and stop answering phone calls, requiring that someone restart the session directly from the server. If *DESQview* itself freezes, the server suffers a worse fate: All sessions stop answering the phone.

Nevertheless, Novell's comforting reputation for supporting its products may be the factor that determines your buying




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ACCESS SERVERS

decision. As usual, the company provides a toll-free technical support line, and arrangements are available to obtain a certain number of free help calls. But if no one at your company is registered with Novell as a Certified *NetWare* Engineer, advice can cost you as much as \$100 per call. In any case, the line is open seven days a week, 24 hours a day. Its BBS can also be reached with a toll-free number.

Novell offers a high-quality turnkey package for *NetWare* LANs. The Access Server supplies a decent solution for users with a frequent need to access the network; while it lacks dial-out capabilities, its fine security provisions and good performance for a limited number of users are welcome features.

VESTRA-SUBCO INC.

LANMaster IncomServ

by M. Keith Thompson
and Steve Rigney

LANMaster IncomServ, a \$2,999 multitasking access server marketed by the LANMaster division of Vestra-Subco, accomplishes its multitasking by using a

reliable package familiar to many PC users: *DESQview 386*. LANMaster IncomServ combines *DESQview* with Vestra-Subco's own modem remote-

The LANMaster IncomServ

works across almost
any type of network, but
its provisions for access
security require extra
management.

control program, *IncomReach*, and DigiBoard's *DigiBoard* to provide the multiple RS-232C ports needed in an access server. Contrasted to its competi-

tors, the LANMaster IncomServ has a major advantage and a major drawback: It works across almost any type of network, but its provisions for access security require extra management.

You can use LANMaster IncomServ with *LAN Manager*, *LANtastic*, *NetWare*, and most other common network operating systems. But LANMaster IncomServ's disadvantage comes from its lack of multiplexing drivers for the LAN adapter. Each caller assumes a common network ID with a single set of network privileges. The remote-control software implements security limitations for individual callers through a password system, but an administrator would have to manage this extra security system in addition to the security levels in the LAN operating system. A program that reads a common database of user names (for example, an e-mail package that reads names and resources from the *NetWare* bindery) could also get confused by a common single user name.

The basic four-port LANMaster IncomServ package sells for \$2,999 (or about \$750 per port) and includes all the software and hardware needed for immediate setup and operation. The price may seem

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to compare unfavorably with the \$1,995 list price of the version of Novell's Access Server we reviewed, but note that the Access Server allows only dial-in; LANMaster IncomServ offers both dial-in and dial-out functionality.

PROVEN COMPONENTS

Because LANMaster IncomServ consists of a group of proven products like *DESQview* and the DigiBoard (which is

equipped with an 80188 processor), we found the package easy to install. Clear instructions take you through a relatively simple installation process. The most complex element of the system, *DESQview*, has an installation program that has been refined and proven in many different kinds of machines. Vestra-Subco suggests using a PC with an 80386



Vestra-Subco's LANMaster IncomServ comes with all the hardware and software you need to set up a dedicated 386- or 486-based PC as an access server. Aside from using its own remote control-program, *IncomReach*, the \$2,999 package relies on proven products like a four-port DigiBoard and Quarterdeck's *DESQview 386* to accomplish its multitasking and dial-in/dial-out functions.

or 80486 processor, as well as 1MB of RAM, to run the *IncomServ* remote control program.

According to the manufacturer, you can expand a LANMaster IncomServ access server to 16 ports by adding more DigiBoards, but our experience with these

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The LANMaster IncomServ

did provide good

throughput on our

benchmark tests, besting

even some of the

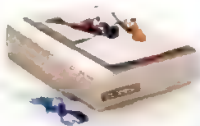
nonmultitasking products.

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multitasking systems shows that in many situations, users will not be happy with the performance of more than four to five simultaneous remote-control sessions. The LANMaster IncomServ did provide good throughput on our benchmark tests, besting even some of the nonmultitasking products. But as the number of users increases, the CPU has a harder time servicing

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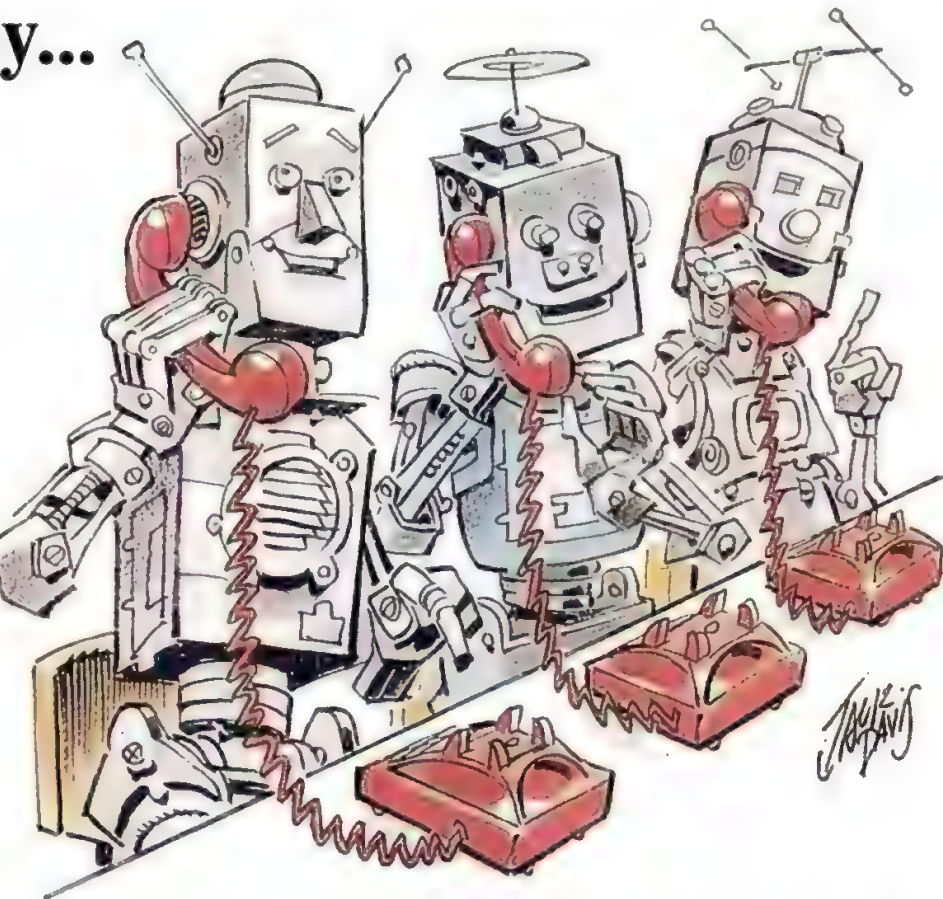
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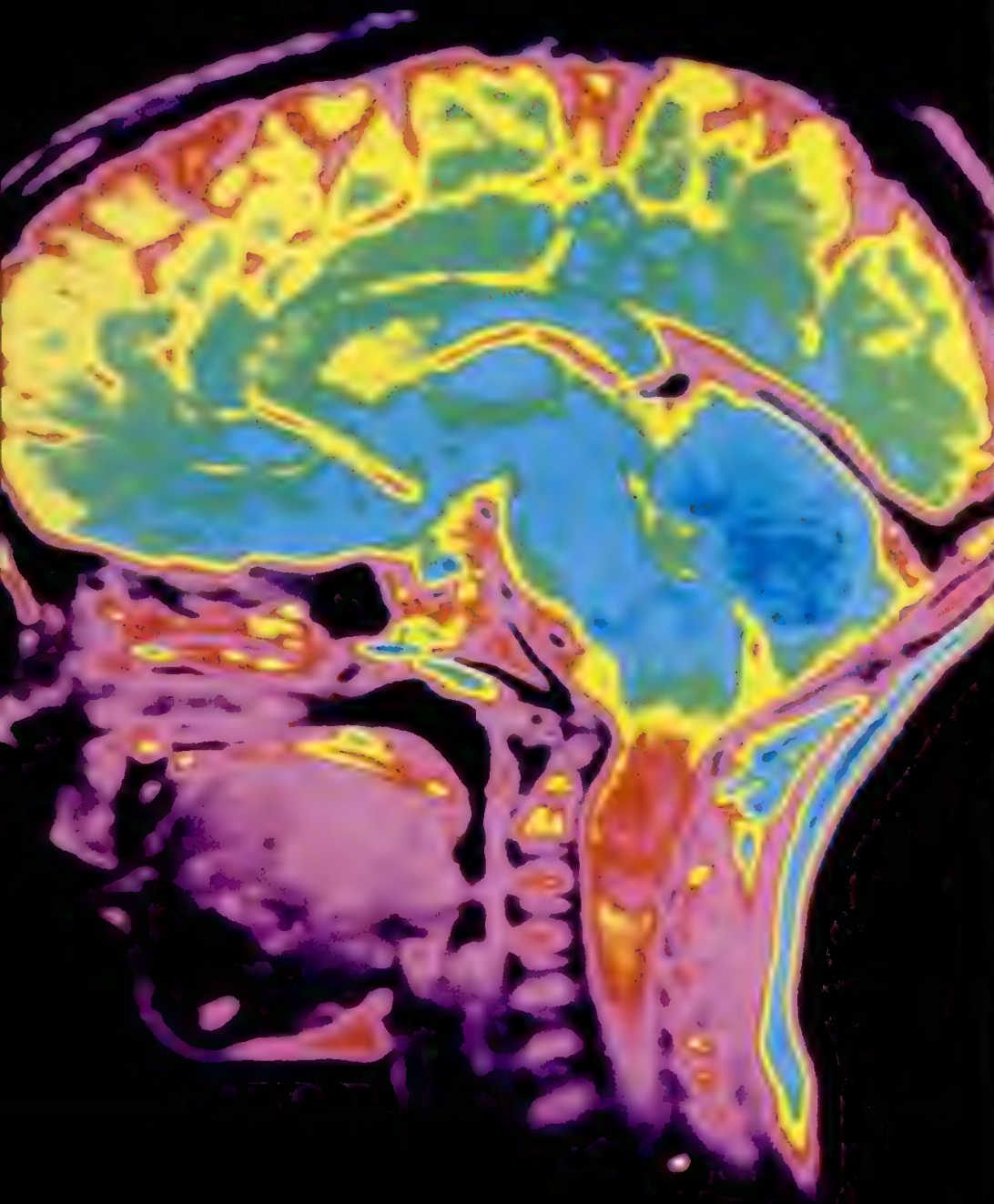
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FACT FILE

LANMaster IncomServ

Vestra-Subco Inc., 1401 N. 14th St., Temple, TX 76501; 800-441-6189, 817-771-2124.

List Price: \$2,999

Requires: 386-based computer or better, 4MB RAM, network adapter, DOS 3.3 or later.

In Short: The LANMaster IncomServ offers a straightforward architecture for an access server using proven products, including DESQview and the DigiBoard. It provides dial-in and dial-out service in a variety of LAN environments, including LAN Manager, LANtastic, and NetWare, but its security provisions require extra attention. The package includes fax-board-sharing capabilities.

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ing all of the interrupts coming from the communications ports. Additionally, you cannot set the DigiBoard to a port speed greater than 19.2 Kbps, potentially limiting the top-end throughput that you could get by utilizing modern modems with V.32bis signaling and V.42bis data compression.

You can designate the computer running the package's software to function solely as an access server or as a combined access server and client PC workstation. The performance of both the access-server operation and the client PC applications will depend on the level of activity on the computer's serial ports. Your ability to get practical use out of the same machine in both functions will also vary, depending on the organization and installation in which you use the LANMaster IncomServ.

DIAL-OUT AND FAX

On the dial-out side, the LANMaster IncomServ comes with its own asynchronous access-server software, *OutcomServ*. *OutcomServ* uses the common INT14 software interface to redirect asynchronous communications activity across the network. The shared-CPU machine you set up can make as many as 16 serial ports available across the network through *OutcomServ*, but again we caution that 16 (via the DigiBoard) is more a theoretical number than a practical one.

A unique feature offered by the LANMaster IncomServ is its *FaxServ* soft-

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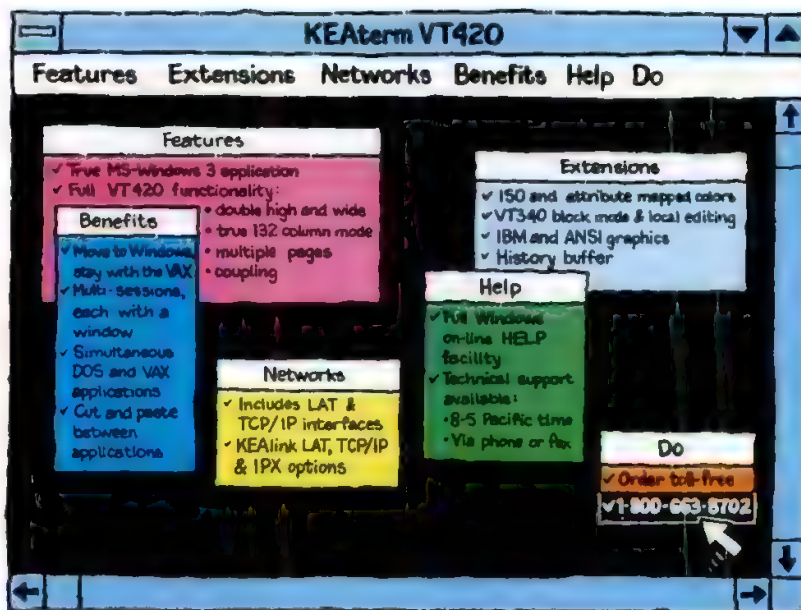
ware, designed to allow users to share fax boards on the shared-CPU machine. Vestra-Subco's complete fax server product includes a fax card with the software. The software allows all the users on the network to send and receive faxes from their desks.

The LANMaster IncomServ is a capable, easy-to-use product with good flex-

ibility. *IncomReach* handles text-based programs only, but in general, you will not want to transfer graphics images across dial-up phone lines. Additionally, the company offers unlimited free technical support from 8:00 to 5:00, E.S.T., and operates a bulletin board. The LANMaster IncomServ will appeal to many users who want a flexible, lower-cost product with proven parts for both dial-in and dial-out service. ■

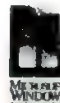
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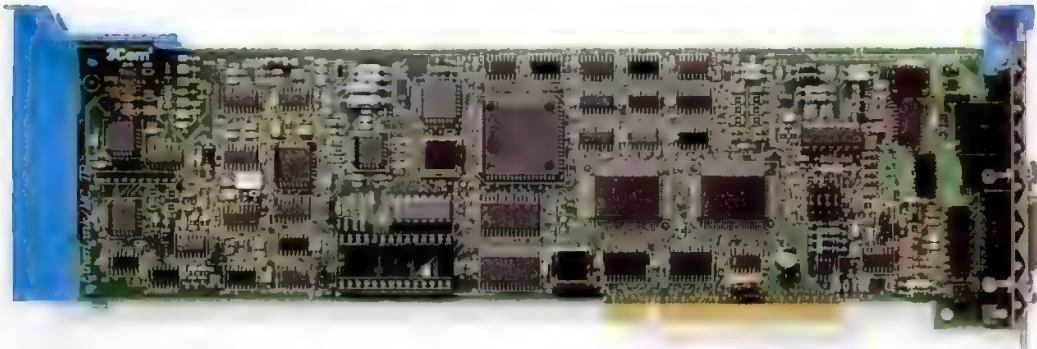
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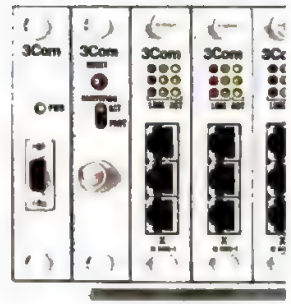
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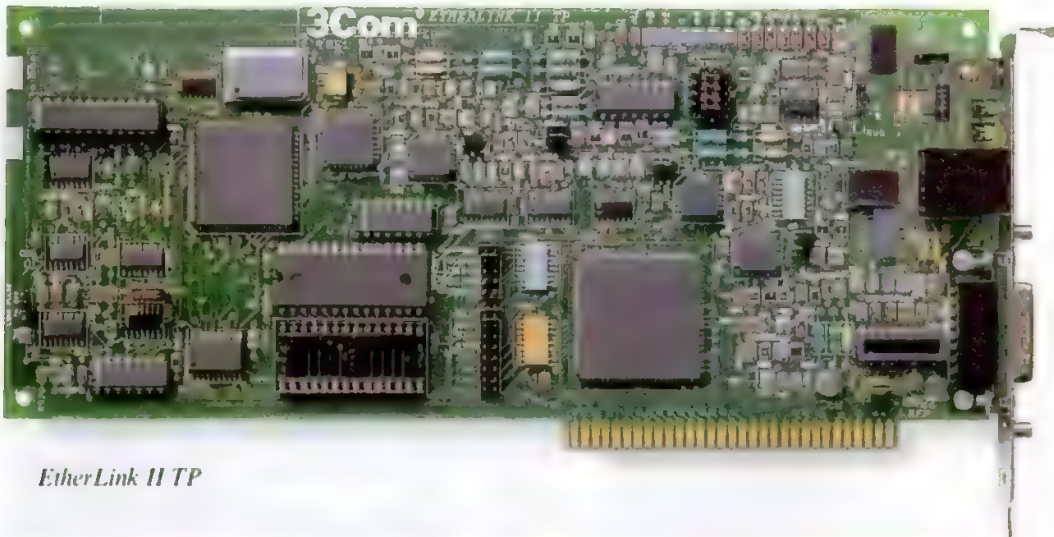
Every twisted question



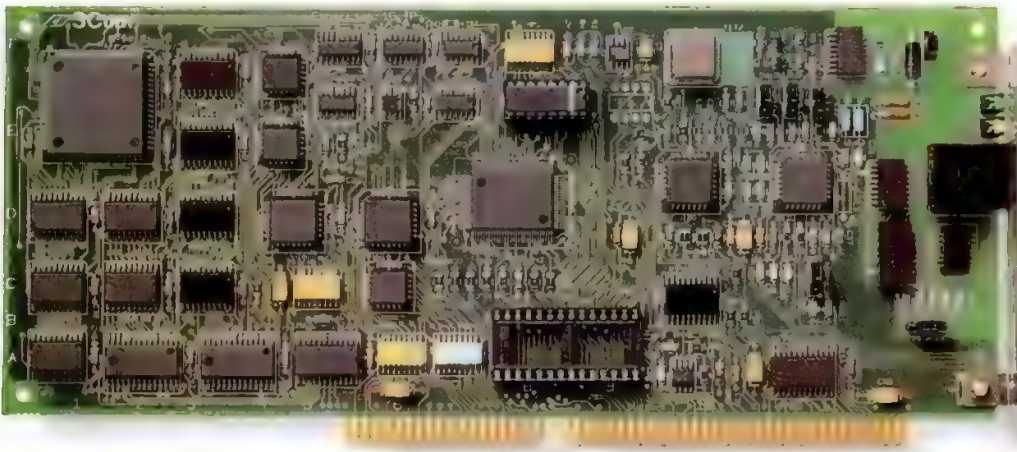
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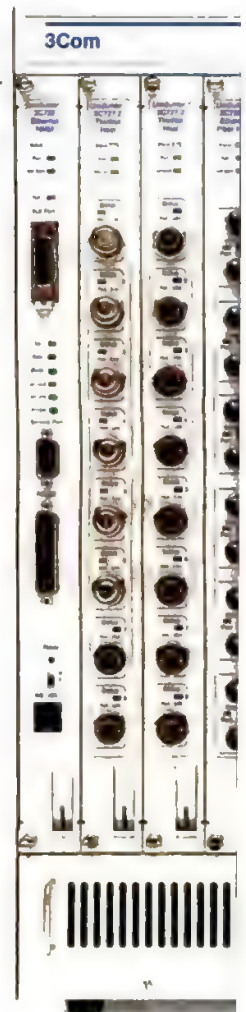
MultiConnect



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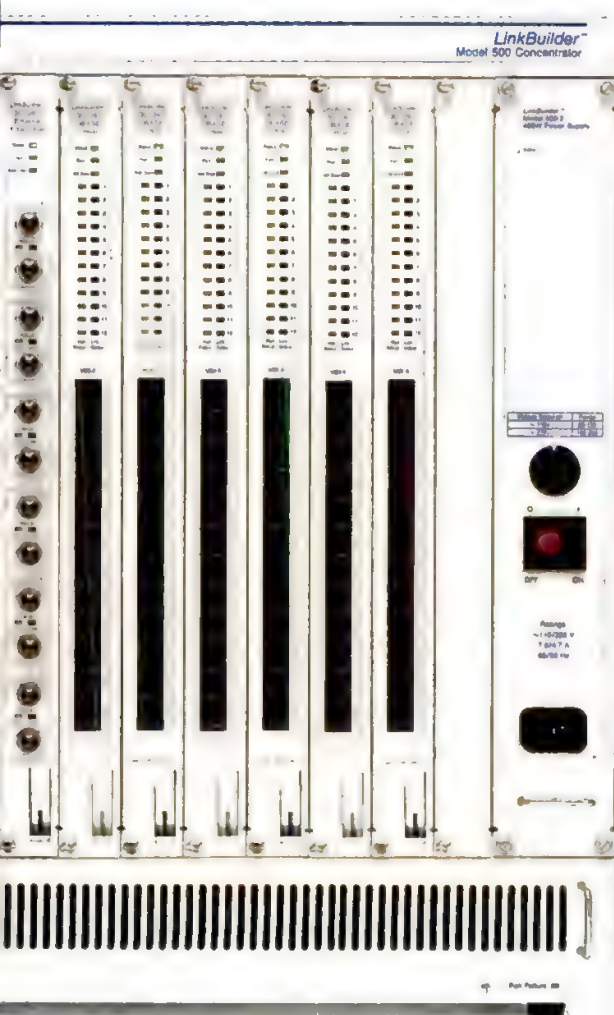


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BULLETIN BOARD SOFTWARE

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Bulletin boards can deal with many users simultaneously, letting them share messages and files with other BBSs via networks such as FidoNet and PCRelay. We have reviewed ten BBS software packages that can serve as wide-area communications tools for business users.

Tools for Wide-Area Communications

BY JOE SALEMI LAN e-mail gateways provide one very useful way to connect an organization's far-flung offices, but they are not appropriate for everyone. For example, they cannot facilitate communications and file transfers among all of an organization's employees when some of its branch offices are not networked. Nor can they support outside, nonnetworked clients that you would like to participate in your e-mail system. And what if you require both a private mail system and

a way to hold public conferences or schedule group meetings and events? While LAN groupware products that incorporate e-mail can fill some of these needs very well, an electronic bulletin board system (BBS) can accommodate all of them.

In its most basic form, a BBS application runs on a host system (usually a dedicated PC) equipped with a single-line modem; users dial into the system through standard dial-up telephone lines, and log onto the BBS. Though a BBS may have many users, in single-line mode only one user can be active on the bulletin board at any one time. Most BBS packages share

common features, and the core function is still the ability to leave public messages on a wide range of topics for all users on the board, or private messages to a particular individual. Other common features include the ability to upload files to and download files from a BBS, present users with an on-line questionnaire or survey, and, sometimes, even allow users to run specially written programs external to the BBS, through what is known as a *door*.

Bulletin boards have been around for almost 15 years. The very first bulletin board software (called *CBBS*, for *Com-*

puter Bulletin Board System) was written by Ward Christensen, who also developed the Xmodem file-transfer protocol; his BBS went on the air in February 1978. This original BBS was strictly for messages; the few folks who had modems could dial in and, through on-line messages, have electronic "conversations" with others who had similar interests. Every BBS package available today has sprung from this humble beginning.

Over the years, the capabilities of the basic BBS have been extended. Two enhancements particularly stand out, especially when you want to use a BBS as a communications tool for your company: the ability to support multiple simultaneous users, and the ability to share messages and files across telephone lines with remote, often diverse, BBSs via BBS networks that use FidoNet and PCRelay technology. These networks are composed of BBSs running special utilities that let the BBSs communicate with each other automatically. Third-party vendors often make the network utilities available for specific packages. One type of utility handles the movement of messages onto the BBS and off it. Another, the external front-end software, answers the phone and passes messages and files to other BBSs, or executes the BBS software for a human caller.

While the ten BBS packages we review here generally can operate out of the box, two require an external front end or other utility to operate. *Maximus-CBCS* requires either a full network front-end package or a small loader front-end package that just answers the phone and passes control onto the BBS software. *Remote-Access* and the DOS version of *Maximus-CBCS* require the use of FOSSIL (a standard interface library) in order to run.

BOARDS FOR BUSINESS USE

While some still see BBSs only as the domain of hobbyists and other special-interest groups, these added capabilities make a BBS a practical business addition or alternative to other LAN-based wide-area network products. Implementing your own private (or in some cases, public) bulletin board system has many advantages. For example, a company with headquarters in New York and regional offices scattered around the country could use BBS packages on their LANs to hook the LANs together over the phone lines, using FidoNet or PCRelay technology. Thus, employees at each office could send pri-

GLOSSARY: BBS Software

by Angela Gunn

■ alias

An assumed name under which users may post messages (for example, Jane Smith may post as "Marketing Group"). The system usually provides a list of aliases and the names of the users to which they belong. Some BBS packages allow anonymous message posting.

■ archiver

A file-compression utility, such as *PKZIP*. On a BBS, large files may be compressed for faster uploading and downloading, or to save disk space. Archivers are useful for graphics and little-used files.

■ door

A program that allows access to files and programs not built into the BBS, letting users run them in the on-line environment.

■ echo

A public discussion group that extends over more than one BBS via echomail. See *SIG*.

■ echomail

A system by which a public discussion group is transmitted.

■ FOSSIL

Acronym for the Fido/Opus/Seadog Standard Interface Layer. This is the interface used as an add-on to mailer packages in order to connect them to

PCs that are not 100 percent IBM-compatible.

■ FREQ

Also known as File REquest; the ability in FidoNet to transfer files back and forth between BBSs automatically. Equivalent to *file transfer* in PCRelay.

■ mailer

Also known as the *front end*; a program that allows BBSs using different software to "talk" to each other. The mailer acts as a transfer layer for the messages passed. Some BBSs require mailers in order to talk to some netmail systems (for example, *Spitfire* for FidoNet). Seadog is generally acknowledged to be the market leader.

■ netmail

Private e-mail sent via the BBS network, either point-to-point (in FidoNet) or hub-routed (in PCRelay). See *echo*.

■ node

An individual bulletin board on a network, which is joined to the other nodes by a *hub*. In FidoNet, nodes may also communicate with each other directly.

■ SIG

A special interest group, or *message conference*, which is an ongoing discussion group on a single BBS. Like echos, SIGs store all messages they receive, allowing users to browse through discussions at their leisure and then post messages to them.

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some things in life are
more important than
your computer...



A man and a woman are on a boat. The man, wearing a dark polo shirt and glasses, stands behind the woman. The woman, wearing a white patterned shirt and glasses, is seated and looking out at the water. The background shows a blue sky and a body of water.

CompuAdd

Time to chart your own course

Detroit automotive transmission manufacturer Borg Warner is switching from mainframe computing to a network of 60 CompuAdd PCs. Why CompuAdd? Information systems manager Vince Chrisman likes our quality, service and pricing. "They perform well, they're cost effective," says Chrisman, who has been buying CompuAdd for over five years. Now, he also buys from CompuAdd because we have a store nearby. "I used to always call the headquarters in Texas — and I got phenomenal service," he says. "But since CompuAdd opened a retail store only a few miles away, I can get parts right away if I need them. It's made my job easier dealing with CompuAdd. It's one stop shopping."

Vince Chrisman, Borg Warner, Detroit

gives you more quality time.



Time to have it your way

Seven years ago, Karl Melter built his own computers from kits. But when the kit companies dropped their customer support, he began to look elsewhere. Melter, a Chicago mechanical engineer, knew what he wanted. And he found it at CompuAdd. "In the store," he recalls, "there was a cutaway CompuAdd computer, so I could see how well it was made. I said, 'That's the computer I'm going to buy.'" Since then, he's been just as pleased with CompuAdd service. Melter had a motherboard replaced, and he upgraded his system memory. All at his local store. "They're very helpful," he says. "I like the people there."

Karl Melter, Mechanical Engineer, Chicago



Time to get away

When Jim Edwins of Jade Tree Travel in Minneapolis bought a CompuAdd computer and a modem for a branch office in Arizona, he planned on long distance computing. What he didn't plan on was long distance technical help. But after his agent took the system to Arizona, the modem didn't work. CompuAdd stores in Tempe and Minneapolis teamed up to help Edwins discover the problem — his software. "With several technicians on the line, we got back in touch," he recalls. "A travel agent without a computer — you just can't do it. But the people at CompuAdd really bent over backward, and I commend them for that."

Jim Edwins, Jade Tree Travel, Minneapolis



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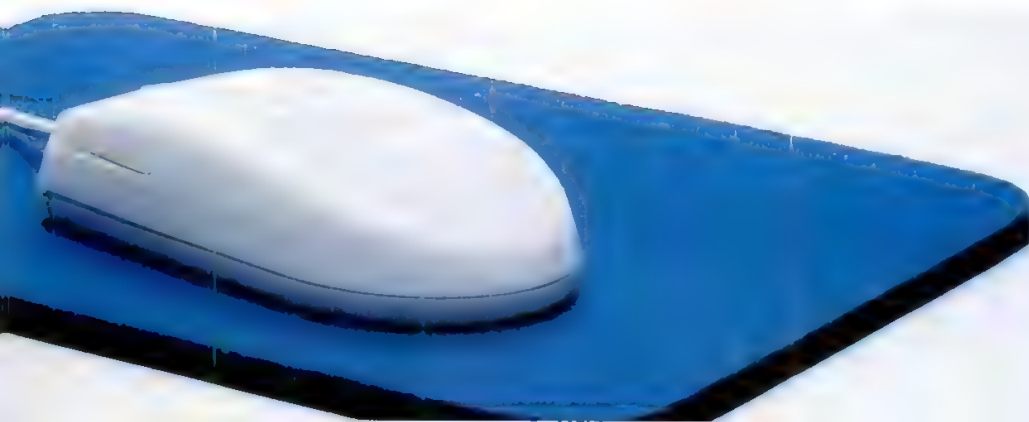
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vate e-mail messages to employees at other offices or participate in company-wide electronic conferences. A user on a remote LAN (or maybe at a branch office that doesn't even have a LAN) can also dial up the BBS running on a workstation at the headquarters' LAN. If the user requests files stored on the file server, the sysop can upload files to the BBS, thereby isolating and protecting the server from outside access. Automatic file transfers can also be set up; for example, to send weekly price updates to all the offices. (See the sidebar "WAITS: Automating Wide-Area File Transfers" for an alternative way to exchange files.)

In another case, a company such as a software developer might want to set up a multiline BBS that resides on a LAN, with each node running the BBS software. The BBS can be used to provide 24-hour technical support, bug fixes, upgrades, and utilities to customers who call in. Companies may choose to make the BBS private, providing access to registered users only, or public, offering limited support to anyone who is "just looking."

Features like

multiuser support
make BBSs practical
business additions.

Another possible use is in a nonnetworked company with a large central office as well as many smaller offices and field representatives. Each remote office can have a single PC running BBS software; the central office can have a multiline BBS for communications with all the outlying offices, allowing them to share e-mail, message groups or conferences, and important company data and files. Remote offices might dial into the central office to get attached to another remote office, or instead dial into it directly. Field representatives can also dial into any of the BBSs from their PCs and have the same access to company information.

Any business contemplating setting up a private BBS should bear in mind that it will also need a system operator, or sysop, to administrate it. The sysop is respon-

BBS SOFTWARE: SUITABILITY TO TASK

PC Magazine evaluates each BBS software package's suitability in four areas that affect your use of a bulletin board as a wide-area communications tool for your employees. Every business user who plans to use a BBS will want a product that effectively supports multiple users and network technologies. The number of access levels and other security features will be most important for those who plan to send sensitive files and messages to remote users. (Please note that good scores in each category do not ensure that a product will be an Editors' Choice.)

Multiuser support measures the product's ability to handle multiple simultaneous users. For a product to score well, it should simplify the setup process in multiuser mode and the addition of more nodes. Other factors that can be important are the ability to support chatting between nodes and a wide range of message and file areas. If the sysop can monitor all active nodes from a central location, if each node's subdirectory can contain only the system files specific to it, or if local users can log onto the BBS automatically via batch files, that can also play a part.

handling, and will usually work with a selection of third-party network utilities. The number of networks the product supports can also be a factor.

Customization rates the product's ability to be tailored to meet your needs and provide the "look and feel" you prefer. All BBS packages let you customize them to some degree, but not all let you do it on full-screen editors. Another important factor can be the degree to which you can modify the user interface, information files, and questionnaires.

Networking assesses the ease with which the product lets you transfer messages and files to remote BBSs via networks like FidoNet, PCRelay, or even proprietary networks. A product with a good score in this area will generally have some features that facilitate hooking into a FidoNet or PCRelay network, such as built-in mail

Security measures the product's ability to protect messages and files from access by unauthorized users. The more access levels a product provides, the better it scores in this area. The presence of "user flags" further extends security, as does the ability to have private, password-protected areas for messages and files.

N/A—Not applicable: The product does not perform this task.



FIDONET AND PCRELAY: Technologies for Networking Your BBS

by Joe Salemi

Long before interest rose in interconnecting local area networks to share data and electronic mail, a different kind of wide area network was already in place. Hobbyists and software authors wrote utilities that let them automatically share files, messages, and e-mail among various BBSs. The original method of doing this has evolved into FidoNet and networks based on FidoNet technology. Over the years, an alternative networking technology called PCRelay has also emerged.

THE FIDONET STORY

The origins of FidoNet date back to the early 1980s, when the two authors of the BBS software *Fido*, who lived on opposite coasts, needed an easy way to exchange modifications they made to the source code. They designed a system where, as a nightly event, the board would shut down and run utilities that automatically transferred the changed files between the authors' BBSs. The logical next step was to permit the exchange of private mail messages, called NetMail, between the sysops.

The authors found these capabilities so useful that they included them as part of the *Fido* BBS package. It didn't take long for an informal network of *Fido* nodes to come into existence, all running the *Fido* software and exchanging various utility and program files and NetMail among sysops.

Like other BBSs, the FidoNet BBSs had their own SIGs, or special-interest groups, where users with similar interests could exchange messages in a way similar to what on-line services call conferences or forums. By 1986, a *Fido* sysop had extended the NetMail concept to allow SIGs to share public mes-

sages among the BBSs, and EchoMail was born.

In the years since, BBS authors and FidoNet users and sysops extended these capabilities to other BBS packages, and FidoNet grew. It currently has over 11,000 nodes covering most of the world.

Other public and private BBS networks use FidoNet technology under other names. In fact, since FidoNet itself is staffed mainly by volunteers who run local, regional, or national hubs as a hobby, you'll want to set up your own network using the FidoNet technology to ensure that your business communications always get through (you can use the same BBS package and utilities you would use on FidoNet).

Many of the existing public and private networks go through FidoNet gateways into the Internet Mail system, which carries e-mail over a group of interconnected networks to universities, government agencies, military branches, and corporations. The *Fido* BBS software remains a single-user package, however, which is why we did not include it in our reviews.

HOW FIDONET WORKS

FidoNet technology uses store-and-forward messaging and is based on point-to-point communications between nodes. A unique address in the form of <zone>:<network>:<node #> identifies each node ("zone" here refers to the continent).

In a direct-connect configuration (used mostly for private mail), nodes can hook right to remote nodes that may be running another BBS package, and centralized hubs are not necessary. However, because of the large number of systems that can exist in a network using FidoNet technology, the technology has also evolved to permit a star topology, with each node in a network calling the local hub. This method—the one most often used for exchanging public messages—makes administration easier. The local hub either distributes new messages to other nodes or

sends them up the line to regional and national hubs, as appropriate (you should note that a local hub can double as a regional hub). A network-specific node list describes the different nodes, including their locations and telephone numbers, and governs which systems are allowed to exchange files and mail bundles.

The transport layer between nodes is generally the front-end software, or mailer software. The front-end program answers the phone and determines whether the caller is a person or another BBS. For users, the front end shells out and runs the BBS software. If the caller is another BBS, the front end accepts the incoming mail bundles or files, checks its own outbound message area against the node number of the calling BBS, and transfers any waiting files or mail to that system. The two most common front ends are *Binkleyterm*, a free package available on most FidoNet BBSs, and *SeaDog*, a \$125 program from System Enhancement Associates (925 Clifton Ave., Clifton, NJ 07013; 201-473-5153).

Since each BBS software package has a different method of storing messages, BBS-specific utilities are required to *toss* and *scan* the EchoMail and NetMail bundles; that is, to move the incoming messages to the BBS and move the outgoing messages from the BBS to the outbound area. Generally, the message-handling software uses an archiving program to pack the mail bundles in order to reduce size and transfer time before sending them. If a BBS vendor does not distribute its own toss/scan utility, the manual usually suggests compatible ones.

A FidoNet BBS also needs separate utilities to specify which files have to be transferred between systems. Originally, FidoNet BBSs created and transferred their mail bundles during the early morning hours; however, "crash mail" has become common, allowing messages, files, and mail to be transferred during times when the BBS software is idle.

PCRELAY AND RIME

PCRelay started out as PCBRelay. When the system was originally set up in 1987, it supported only *PCBoard* BBSs. In 1989, the author developed UTI (Universal Text Interchange), which extended the abilities of PCBRelay to other BBS packages. The system then became known as PCRelay. PCRelay needs BBS-specific utilities in order to move messages between the BBS and UTI.

Although they basically accomplish the same thing, PCRelay tech-

them. Instead of going directly to its destination, electronic mail between systems is routed through the hub.

The largest PCRelay network is the Relaynet International Message Exchange (RIME), which has about 1,000 systems. A number of smaller public and private networks are also based on this technology. As with FidoNet, if you use the PCRelay technology, it's a good idea to set up your own network to ensure the safe passage of your important business data. At this time, PCRelay offers no gateway to other mail systems, although MHS and Internet gateways are planned for a future release.

Unlike FidoNet networks, which you can set up with public-domain or copyrighted free software, or with your own custom-written programs, PCRelay still uses a proprietary network protocol; the necessary software is available only from one source. If you should set up a PCRelay system, you'll require at least one hub. The hub software costs \$60 per hub, while the node software costs \$30 per node. It is avail-

able from Bonnie Anthony (6901 Wittier Blvd., Bethesda, MD 20817), or you can connect by modem to The Running Board BBS at 301-229-5623.

NETWORKS FOR BUSINESSES

Both the FidoNet and PCRelay technologies provide similar functions. The wider availability of support software for FidoNet, coupled with its ability to transfer messages and files at any time, makes it a better choice for those interested in setting up a companywide BBS network.

On the other hand, because of PCRelay's close relationship with *PCBoard*, users running a *PCBoard* BBS may find PCRelay, with its tree-structured topology, a better networking solution. *PCBoard*, however, also supports FidoNet technology. ■

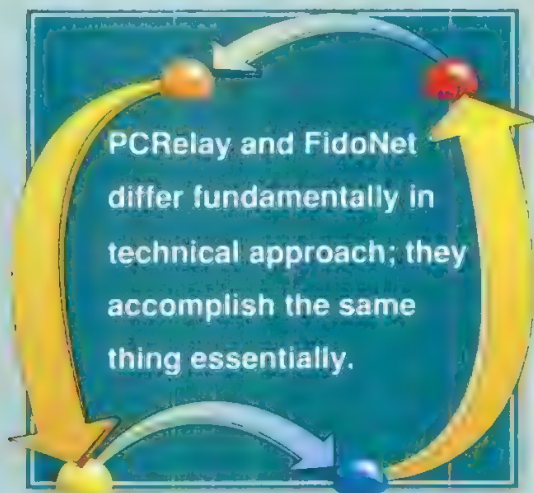
sible for setting up the BBS and maintaining it on a day-to-day basis. Depending on the size of the BBS and the number of users, maintenance can take as little as an hour each day, or enough time to require a full-time employee (who in many cases can be the LAN administrator).

An important consideration when using a BBS is security. There are two types of particular interest: access security and network security. Access security is built into each BBS package and controls what the user of the BBS can and cannot do. The sysop can set up the BBS with different levels of access, so that one group of users can see only certain message groups or file areas and another group can have access to other specialized areas of concern only to it. Access levels are usually controlled by a numeric scale. The sysop sets up a particular area or function with a security number; only users with an access level of the same number or higher can use the function. Some packages (such as *RemoteAccess* and *TBBS*) extend the security features to include "user flags." These flags are implemented as an on/off bit in the user record and a particular area or function on the BBS. The user must have the same bit turned on as the bit in the particular area to be able to access that area.

Network security, implemented in the external front ends used for communication between the various BBSs, consists primarily of passwords. The front end can be set up so that a connection between it and another BBS's front end can be made only if both have the same password. This helps insure that "unknown" systems cannot access the messages or files on your BBS.

REVIEW CRITERIA

For this review, we rounded up commercially available bulletin board software packages, shareware programs, and copyrighted but free (yes, free) offerings. Some commercial packages are also available in a shareware version; given a choice, we reviewed the multiuser commercial version. Prices for commercial packages range from \$119 for a multiuser commercial version of *Searchlight* to \$120 per node for a commercial version of *Maximus-CBCS* to over \$4,000 for a 64-user Super Combo version of *The Major BBS*. You might ask why you would bother to pay for a commercial system when free software is available. The difference is sometimes technical support: With free



nology differs fundamentally from FidoNet technology in the approach it takes. The biggest difference is that PCRelay transfers mail bundles and files through a third-party communications program, such as *ProComm Plus*, *Qmodem*, or *Telnet*, rather than by using a front end. And unlike FidoNet, PCRelay networks still handle outgoing and incoming mail bundles and file transfers overnight.

PCRelay also uses a different topology: It identifies boards by an eight-letter name and ID code rather than a node number. The networks are set up in a tree structure where all the nodes have to call a central hub instead of being able to contact each other directly, even for private mail. The central hubs may be regional, and they may have higher-level hubs above

A TYPICAL NETWORK USING FIDONET TECHNOLOGY

FidoNet and networks based on its technology use a point-to-point system, allowing maximum flexibility. The source node, which is the PC that actually talks to the BBS network, usually sends files and private mail directly to the destination nodes. (A source node BBS, of course, becomes a destination node when it is receiving files and mail.) A source node may be one of the workstations on your local area network, or it may not reside on the network at all.

To simplify connections, FidoNet networks typically use a series of tree-structured or star-topology BBSs. Public messages are forwarded from a node to the nearest connected hub for distribution to other hubs and nodes. In some situations,

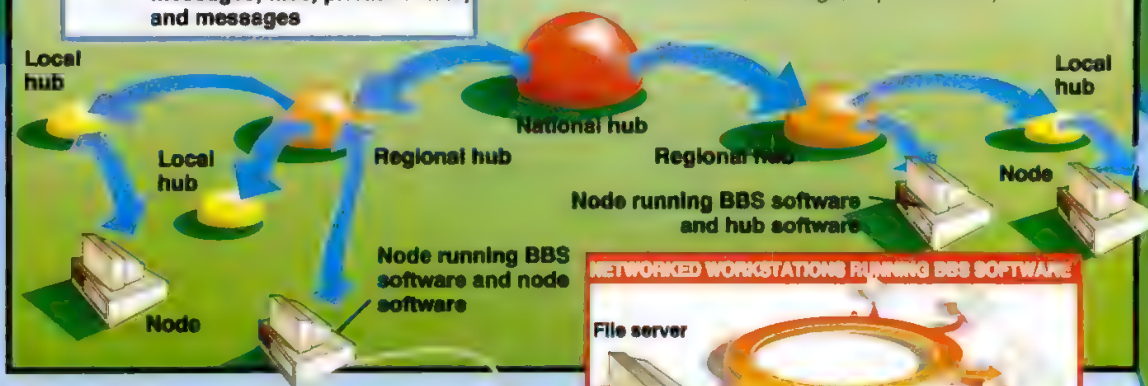
A TYPICAL NETWORK USING PCRELAY TECHNOLOGY

PCRelay and networks based on its technology use a tree-structured topology: Each node is a PC system running BBS software. Each node also runs node and hub software; the nodes may or may not be part of a local area network. A node passes all files, public messages, and private mail to its hub, which may be local or regional. The hub then passes the messages on to other nodes and forwards the mail and files to the destination node if it is below that particular hub in the tree structure. Every hub may also have another hub

above it, where it passes messages, mail, and files if they are destined for nodes the hub does not service directly.

The topology outlines the distribution of public and private messages and files using a network based on PCRelay technology. The small inset below depicts a typical scenario, showing how a network of PCs can send messages to remote nodes. Here, networked PCs, which are running BBS software off a file server, connect via the server to the PC running the node software. (In this diagram, we call attention only to the hub software running on the node that ultimately receives the file, message, or private mail.)

Two-way transfer of echo messages, files, private e-mail, and messages



Two-way transfer of public messages

Point-to-point transfer of files, private e-mail, and messages

the sysop may also route mail through the hubs to save costs.

The topology outlines the various connections possible among nodes and local, regional, and national hubs. The inset diagram depicts a typical scenario, showing how a network of PCs can send and receive messages to and from a node PC. In this instance, the networked PCs, which are running BBS software off a file server, connect via the server to the node PC, which is also running the BBS software in addition to the mailer software. In one connection, the node routes public messages through local, regional, and national hubs until they reach a distant node. In another, it exchanges private mail directly with another node.



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CONNECTIVITY

BBS SOFTWARE

software and even some shareware, support frequently comes from the author, but often much of it is in the hands of volunteers, who can stop at any time.

We required that the BBS software packages run under DOS and be able to support multiple simultaneous users as well as FidoNet, PCRelay, or proprietary network technologies. We also required that, regardless of the method used to support multiuser operations, the software be able to run on a workstation attached to a LAN and use the LAN's file server for storage of data. We looked only at software packages that allow the exchange of private messages with users on that or another BBS system, either through built-in capabilities or through third-party utilities. Support for modems with sending speeds of 9,600 bps or greater was another requirement and a particularly

A wealth of

configuration

options awaits the

unknowing sysop.

important one, as these devices are becoming more plentiful. In fact, they are rapidly becoming the standard for business use, particularly when files must be transferred between remote sites.

Finally, we required that the packages reviewed allow the sysop to perform user and system maintenance functions by dialing into the BBS. This allows a company with a number of remote sites to have one sysop responsible for supporting the whole WAN.

Ten BBS packages provided all these features. Reviewed here are *The Major BBS*, *Maximus-CBCS*, *Oracom-Plus*, *PCBoard*, *RBBS-PC*, *RemoteAccess*, *Searchlight*, *Spitfire*, *TBBS*, and *Wildcat!*.

When it comes to supporting multiple simultaneous users, the reviewed software fell into two categories: those with native (built-in) multiuser support and those that require a LAN or a third-party multitasker (such as *DESQview*, *OS/2*, or *Microsoft Windows 3.0*) to allow access to multiple users. Only three BBS packages—*The Major BBS*, *Oracom-Plus*,

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and *TBBS*—have these facilities built into them.

The ability to share messages and files with other BBSs, whether using FidoNet or PCRelay technology or a proprietary scheme, is not usually built in. The majority of products provide it via external utilities available from the vendor or third-party sources. Some products, like M&M Associates' *Auntie* and Dynamic Micro-processor Associates' *The Chairman*, provide multiuser support but do not support networks; Fido Software's *Fido* and Opus Software's *Opus* have built-in support for FidoNet but not for multiple simultaneous users. In addition to the wide-

area network capabilities provided by the FidoNet or PCRelay networks, an organization can use these technologies to participate in a public BBS network and access the wealth of technical support available there.

Most of the products let users on a LAN workstation access the BBS directly, without having to dial in. This capability provides the BBS with the means to function as an in-house electronic mail and conference system, in many cases for a reduced cost over traditional LAN groupware or e-mail packages.

REVIEWING THE SOFTWARE

All of the packages that required external utilities for multiuser use were originally installed in single-user mode, and then moved to a multiuser platform (we tried them on LANs and under *Windows 3.0* in Enhanced mode). The installations proved that setting up and running a BBS can be a very complex task. A wealth of configuration options and available functions awaits the unknowing sysop, and a sturdy manual with a well-designed table of contents and an index proved vital to successfully completing these tasks.

During our testing, we accessed the systems locally (that is, via a LAN work-



EDITORS' CHOICE

- **PCBoard**
- **RBBS-PC**

The BBS market has matured over the years to the point that any BBS available today must have a basic set of features to make it successful for business applications. Among these features are the abilities to support multiple simultaneous users and to use a file server on a LAN to store data. Of course, the systems must also be able to share messages and files with other BBSs via FidoNet or PCRelay technology or a proprietary network, and must offer dial-in access for the sysop. All ten packages we reviewed include these features. What sets the Editors' Choice winners apart is not only the streamlined way in which they implement most of these features, but the wealth of other options they include to make your BBS as accessible and customizable as you require. Of all these packages, two stand out for their range and depth of features: *RBBS-PC* and *PCBoard*.

RBBS-PC demonstrates the value of team effort. Many experienced *RBBS-PC* sysops beyond the program's originators have had a hand in keeping this first BBS for DOS-based PCs current. Points in its favor include a highly customizable interface (a utility lets you select from 327 different configuration parameters), security that extends to 65,536 access levels, and an excellent

manual that anyone planning to run *any* BBS should read, simply as a design guide. The product is unique among those we reviewed in that it includes a fast file-search facility and built-in support for sight-impaired sysops. And you can't beat the price—free for the downloading!

PCBOARD:

EFFICIENT MANAGEMENT

PCBoard excels in its ease of installation, setup, and maintenance on a LAN, making it a good choice for everyone, but especially the novice sysop. Its support for 65,000 message and file areas strengthens its application in situations where many users will access the system. Add utilities that examine and modify user accounts, scan for duplicate or missing files, and sort download files, and you have one very efficiently managed BBS. It could use better security but otherwise, the product is a model of intelligent design. Unlike *RBBS*, *PCBoard* carries a price tag (\$240 for the minimum multiple-user version with doors). But in *PCBoard*'s favor are telephone technical support and a 24-hour BBS courtesy of Clark Development Co.; although *RBBS* users can get technical support through a number of BBSs, they

have no central location to turn to for help.

HONORABLE MENTION: TBBS

In general, the native multitasking products do not have the range of features available in the packages that support multiple users via multitaskers like DOS, OS/2, or LANs. But if you have to support more users on a single PC than its three or four communications ports can normally support, these products (the only ones we reviewed that work with multiport boards like the Digiboard) are your only choice. Of the three systems you can use if you need to set up a central system without setting up a LAN, *TBBS* (\$895 for its minimum multiuser version) deserves an honorable mention.

Providing over four million effective access levels, *TBBS* is one of the leaders of the bulletin board software pack in security. With a handful of well-implemented full-screen configuration utilities, the system is easy to define. The product also lets BBS users hook into *dBASE*-compatible programs via an extra-cost *TDBS* module, making the flow of information that much smoother.

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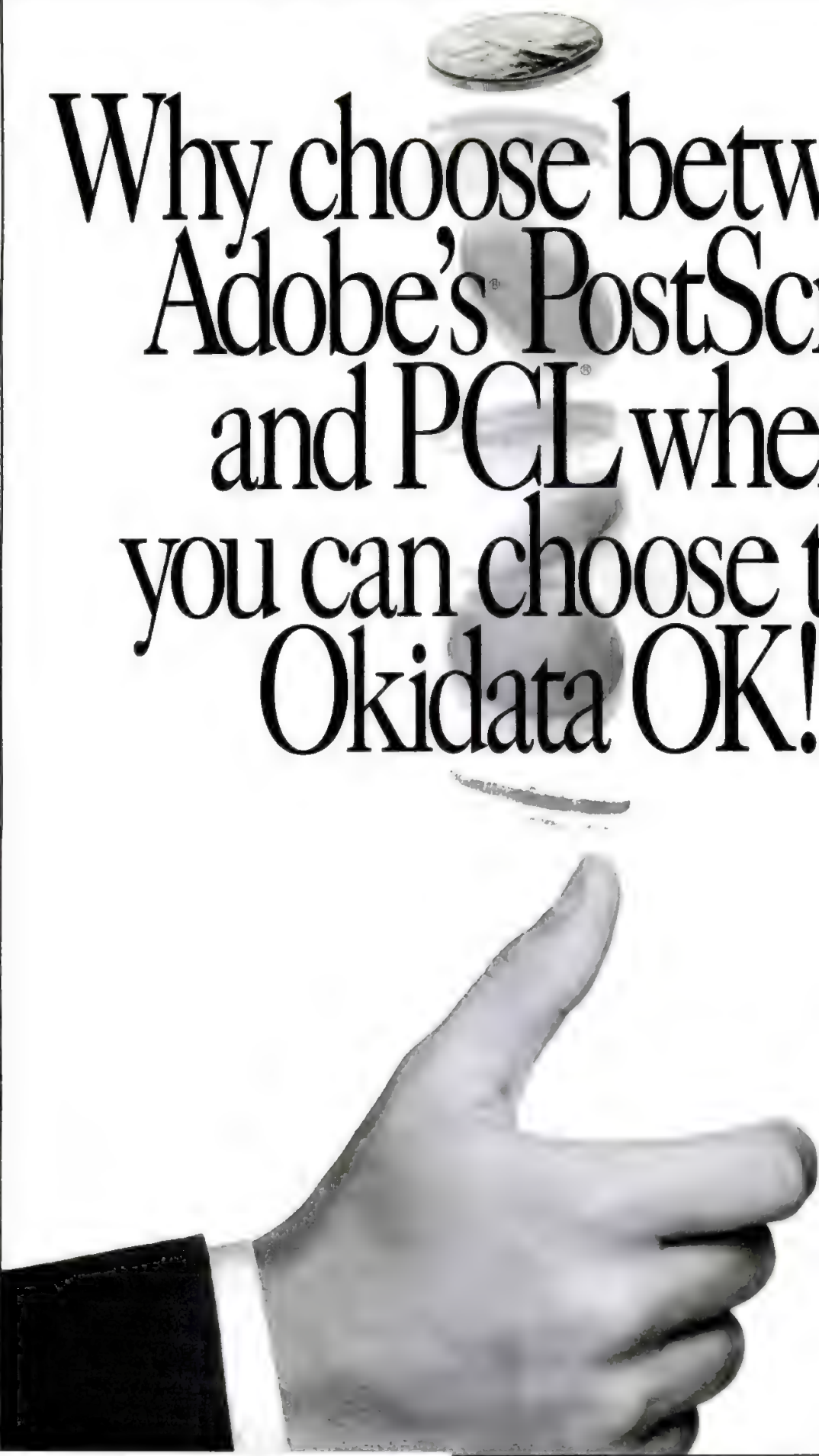
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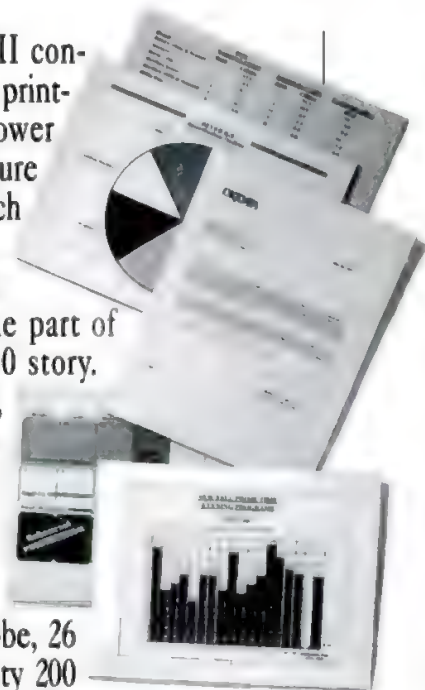
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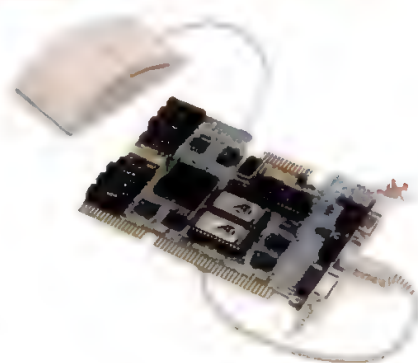
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THEY WENT THAT-A-WAY: BiModem Lets BBS Users Send and Receive Files Simultaneously

by Joe Salemi

If you make a lot of long-distance calls to upload and download files from a BBS, you will be interested in a transfer protocol that cuts your costs by doing both at the same time. *BiModem*, a shareware program from Erik Labs, is the first and only package of its kind: a bidirectional file-transfer protocol. Using the full-duplex features of most current modems, *BiModem*, Version 1.24, lets you send files or groups of files to another system while simultaneously downloading any number of files from that system. It is available for a \$25 registration fee from various BBSs and on-line services such as CompuServe.

BiModem provides you with complete control over accessible directories and files and gives you the ability to password-protect a file. Like the Zmodem protocol, *BiModem* has a crash-recovery feature and can resume an aborted download where it left off without resending the entire file. Full 32-bit CRC (cyclical redundancy checking) and file-sum checking help reduce the possibility of errors during the transfer.

You can mark files you want transferred in a full directory-tree window, or *BiModem* can use an ASCII list of predetermined files. You can also add files to the transfer list while other files are being sent or received. *BiModem* includes a hotkey TSR utility called BiHot that displays file names on the screen, lets you mark files you want to receive, and automatically builds a download list.

The package includes an automatic setup program with default configurations for a number of communications programs, including *Boyan*, *ProComm*, *QModem*, and *Telnet*. The Erik Labs support BBS offers additional utilities for interfacing *BiModem* with various BBS packages, such as *PCBoard*, *QuickBBS*, *RBBS-PC*, *RemoteAccess*, and *Wildcat!*. These interface utilities are all shareware, ranging in price from \$10 to \$25.

The *BiModem* distribution disk includes a copy of the manual, and a printed and bound version is available for a \$7.50 fee. The manual also includes information on configuring *BiModem* in a *DESQview* or LAN environment. At press time, marketing and support for the product had just been taken over by Optisys (Phoenix, AZ; 800-327-1271), which now sells it in a \$69.95 commercial version. The shareware version of *BiModem* is still available at this writing, but will eventually be phased out.

HOST OF CONTROL UTILITIES

You can invoke BiMenu, *BiModem*'s master control program, from the DOS command line or through a hotkey or script file inside a communications program. You can then call other *BiModem* utilities through BiMenu. One such utility, BiMark, offers a directory-tree interface for building upload lists. Another utility, BiList, allows you to scroll through a download list on the remote system to mark files for downloading. With BiList, you or someone at the remote system needs to create the download list beforehand. The BiHot TSR described earlier lets you make the list while you communicate with the other system. BiMenu, BiMark, BiList, and BiHot all come packaged with *BiModem*.

Once the file lists are ready, you transfer the files by invoking the main *BiModem* program. Transfers take place automatically when the program on one end detects that the other end is ready. You can activate the file-transfer program through a batch file, making it easy to set up unattended file transfers. BiMark and BiList can also run unattended through a batch file.

BiModem contains another unique feature: Operators on both ends can

carry on a real-time chat while they transfer files. This function affects file-transfer efficiency slightly, but it's handy when, for example, a sysop needs to help a new user get *BiModem* operating correctly.

Support for *BiModem* is available through the author's BBS and a FidoNet echo. In informal, single-file transfer tests on a 2,400-bps, MNP 4 link-up,



The BiMenu screen is the main control panel for *BiModem*, a program that allows you to send and receive files simultaneously. From BiMenu, you can call various *BiModem* utilities.

BiModem was as fast as Zmodem. (We used a current version of *DSZ* for comparison.) For two-way transfers, we found it increased efficiency 20 to 30 percent.

Although overhead and technical constraints prevent it from providing a full 50-percent increase in file-transfer speed, *BiModem* can make a big difference in file-transfer efficiency. For individuals or organizations that need to do a lot of long-distance file transfers, *BiModem* can be a big plus. ■

BiModem, Version 1.24

Erik Labs, 3431 W. Thunderbird Rd., #13-311, Phoenix, AZ 85023; 602-942-5403; BBS: 602-866-9229.

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station) and through a modem. In either situation, performance usually depends on a number of outside factors rather than the software itself, including the speed of the machine the BBS runs on, the speed of the modems, and the number of simultaneous users.

Although every package comes with default character-based menus and text screens, we found the user interface of each BBS to be relatively unimportant, because every system provided a means of modifying it. The degree of interface customization available, such as color menus, ANSI graphics, and the arrangement of the menu items, varies widely from system to system.

LAN AND WIDE-AREA CAPABILITIES

One interesting fact that emerged from the review process was the difference in LAN capabilities between the two categories of BBS software. While they could all run from a LAN workstation and access the hard disks on the file server, none of the three packages with native multiuser capabilities could be accessed from another workstation on the same network. To support their internal multitasking, these packages had to run on a dedicated PC; access could come only through comm ports attached to that machine.

With one exception, none of the products can dial out from modems on an asynchronous communications server. They require the modems to be attached directly to the PC the software ran on. The exception is the OS/2 version of *Maximus-CBCS*; using OS/2's ability to share serial devices across the LAN, it can access a modem that resides on a LAN *Manager* peer station or file server.

A few of these packages—*Maximus-CBCS*, *PCBoard*, *RemoteAccess*, *Searchlight*, and *TBBS*—not only allow private messages among users but even let the sysop set up message conferences where only private messages are allowed. Using a BBS as an e-mail system has one major drawback; unlike the e-mail systems designed specifically for LAN use, the BBS software does not allow messages to be sent to a predefined group (or mailing list) of users. Also, none of the packages had any facility for displaying a list of users while addressing the e-mail: The sender has to remember the correct name of the recipient. Nor did any of them provide the sender with a return receipt for a message sent outside the local BBS, to confirm that the message was received.

PUTTERING THROUGH PROTOCOLS

Among the features common to all the BBSs is the ability to transfer (upload and download) files. Most of the packages support a number of common built-in file-transfer protocols; all provide at least the basic Xmodem protocol. Most of the packages also have a facility for adding in external protocols.

Even today, there is still some confusion about which protocol can lay claim to being the real Xmodem or Ymodem. In the reviews and the features table that accompanies them, Xmodem refers to the original 128-bytes-per-block protocol. Many BBS vendors use Xmodem-1K (the

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Every BBS package

provides a means of

modifying its user

interface.

.

variation that uses 1,024 bytes per block) interchangeably with Ymodem (the 1,024-byte-per-block batch protocol), although they are not the same thing at all. In an effort to avoid all this confusion, many vendors refer to the "true" Ymodem as Ymodem-Batch. Some even list all three variations and vary on whether their Ymodem is the same as Xmodem-1K or Ymodem-Batch! When a vendor used Ymodem to mean Xmodem-1K, we listed it as Xmodem-1K. However, the use of Ymodem-Batch to mean true Ymodem is so prevalent that we list the product as having both Ymodem and Ymodem-Batch when the Batch variation is all that the vendor lists.

Another variation on Xmodem-1K that appeared in a few of the packages we looked at is Xmodem-1K-G. This is a streaming protocol variation similar to Ymodem-G. The protocol provides no internal error correction and is designed for use with modem-based error-control connections (usually using MNP 4 or V.42).

Some BBS packages come with Zmodem, which provides 32-bit CRC (cyclical redundancy checking) error

checking, dynamic block sizes, and "crash recovery" as an internal protocol, allowing the user to restart an aborted transfer from where it left off. Those packages that do not have Zmodem either make it available through an add-in module or support the addition of Zmodem through the use of Omen Technology's *DSZ*. External support for Zmodem has the advantage of making it easier to keep up with changes, but *DSZ* carries a \$20 registration fee. Many of the packages also provide external support for Erik Labs' *BiModem*, a protocol that allows the user to upload and download files at the same time, saving transfer time and costs (see the sidebar "They Went That-A-Way: BiModem Lets BBS Users Send and Receive Files Simultaneously").

CHOOSING A BBS

Deciding on the right BBS package for your needs can be difficult. First you must determine whether you need only multi-user dial-in capabilities, or whether the capability to access the BBS directly from LAN workstations is also important. The next step is to determine which of the two different network technologies—FidoNet or PCRelay—best suits your application. Once you make these choices, the final decision rests on deciding which package provides the capability you want for messages, file transfers, doors, and customization. No matter which you choose, one thing's certain: BBSs are not just for hobbyists anymore.

The Major BBS, Version 5.20

All reviews by Joe Salemi

.

Galacticomm's *The Major BBS* takes a modular approach to BBS communications, letting you add features like an online shopping mall and real-time moderated conferences. *The Major BBS* is one of three BBS packages reviewed here that offers built-in support for multiple users. The \$59 base configuration of the standard version supports 2 simultaneous users; versions for 4, 8, 16, 32, 64, 128, and 256 users range in price from \$359 to \$3,359. The Super Combo version, which we reviewed, is priced at \$829 for 2 users, \$1,129 for 4 users, and \$4,129 for 256 users, with a range of options in between. This package includes four add-on modules (*File Library*, *Entertainment*, *Shop-*

CONNECTIVITY

BBS SOFTWARE

FACT FILE

The Major BBS, Version 5.20

Galacticomm Inc.,
4101 SW 47th
Ave., #101, Fort
Lauderdale, FL
33314; 305-583-
5990; The Major
BBS Demo
System BBS:
305-583-7808

List Price: Standard package: 2-user version, \$59; 4-user version, \$359; 8-user version, \$659; 16-user version, \$959; 32-user version, \$1,259; 64-user version, \$1,559; 128-user version, \$2,159; 256-user version, \$3,359. Super Combo package: 2-user version, \$829; 4-user version, \$1,129; 8-user version, \$1,429; 16-user version, \$1,729; 32-user version, \$2,029; 64-user version, \$2,329; 128-user version, \$2,929; 256-user version, \$4,129.

Requires: 512K RAM, 20MB hard disk, DOS 3.0 or higher. 286 machine or better recommended for three users or more.

In Short: *The Major BBS*, a native multiuser BBS package, has strong support for real-time conferences and on-line sales; its main drawbacks are weak security and documentation. The software is available in a Super Combo package and in individual modules. Galacticomm also markets hardware for it.

CIRCLE 415 ON READER SERVICE CARD



connection to an X.25 network, using the OST \$1,525 PCXNet board and Galacticomm's X.25 software option.

TRIAL-AND-ERROR SETUP

Installing *The Major BBS* is simple, but customizing it isn't. The software automatically reads the hardware configuration of the machine and provides a default setup for all available ports. The BBS should reside on at least a 20MB hard disk. Once installed, a quick-configuration option on the main menu asks you to add your name and your BBS's name. You can choose from two more levels of configuration options, but they become increasingly complex. A two-line on-screen window provides the only help. The manual does a woefully inadequate job of describing these advanced configurations.

In fact, the manual is one of the weakest points in setting up *The Major BBS*. Although it includes a somewhat helpful index, the documentation is not organized well and does not provide enough information for a new sysop to customize the system. Taking advantage of all its features requires a lot of trial and error; however, Galacticomm's 24-hour BBS does offer help. Telephone support is available from 9:30 to 8:00 E.S.T. weekdays, though the call is not toll-free.

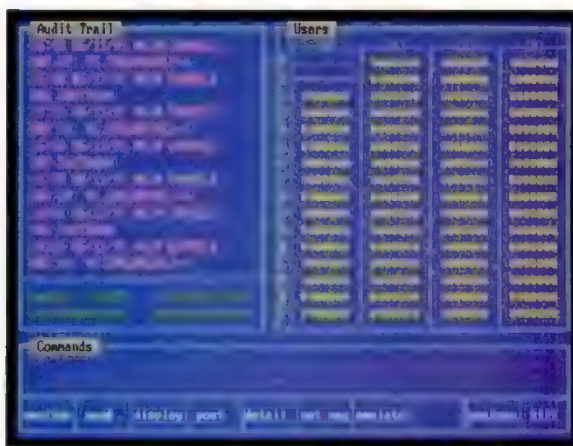
Another weak point of *The Major BBS* is security. With only eight access levels, it offers the least amount of protection against unauthorized access of all the packages we reviewed. Other packages let you designate more than 5,000 access levels (some, more than 50,000), allowing you to protect specific commands and areas. *The Major BBS* does contain a number of user-auditing functions, however, including a real-time monitor that shows the activity on all the active channels at the same time.

EXTENSIVE EXTENSIBILITY

What it lacks in configuration ease, *The Major BBS* makes up for in extensibility. If you want to customize the BBS for particular functions, Galacticomm sells a number of relatively affordable add-on modules (which come standard in the

Super Combo version), including multi-user games, a full-screen message editor, custom-menu designer, and better file-transfer handling through Zmodem and other protocols.

Of particular interest is the Shopping Mall Edition. As an add-on module, it sells for \$249 and provides businesses with increased customer support for on-line order taking or helps them with internal uses such as collecting requisitions for office supplies. Galacticomm also sells a module for \$129 that lets the BBS dial out through a channel to another computer system, allowing it to act, for example, as a user-transparent gateway to a database system on an in-house minicomputer. *MjrFIDO* and *MjrUTI*, third-party utili-



The main screen of *The Major BBS* provides a number of monitoring and system performance functions, with additional information accessed via function keys. An audit trail keeps track of the times your BBS is up and down.

ties that provide *The Major BBS* with support, respectively, for FidoNet and PCRelay message and file transfers, are available from either ProStar Software or Galacticomm. Both are priced at \$150.

Each module takes up additional system memory, and using several of them can reduce the number of users your BBS can support simultaneously. To solve this problem, Galacticomm also markets a version that works in protected mode to access up to 15MB of RAM on 286-, 386-, and 486-based systems. You can buy this as part of the Super Combo edition, or you can buy a C source-code toolkit from Galacticomm for \$195 and build it yourself from scratch.

The best feature of *The Major BBS* is its built-in teleconferencing mode, basically a chat function that supports mul-

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The Major BBS

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tiple users in a public or private real-time conference. If a moderator initiates the conference, he or she has complete control over who can access the conference channel being used. Users can also send private messages to other participants within a public conference.

If your primary need is for real-time conferencing, or a sales-support system, *The Major BBS* is worth a look. But the lack of clear information on how to configure the software can make setting up *The Major BBS* a daunting task for the inexperienced sysop.

Maximus-CBCS, Version 1.02

The only multiuser, FidoNet-capable BBS program currently available in an OS/2 version is SCI Communications' *Maximus-CBCS*, which also comes in a version for DOS. You can download the DOS version, the OS/2 executable file, and the full C source code from about 1,000 BBSs, including the author's (Scott Dudley's Fowl Weather Post MK II at 613-389-8315), and from CompuServe. *Maximus* is copyrighted but free for noncommercial use. A commercial license costs \$110 per node and is required if the BBS makes a profit.

Designed as a replacement for the *Opus* single-user BBS software, *Maximus* bears a strong resemblance to its inspiration. But with multiuser support, *Maximus*'s configurations go beyond those of *Opus*.

FACT FILE

Maximus-CBCS, Version 1.02

SCI Communications, 777 Downing St., Kingston, ON K7M 5N3 Canada; The Fowl Weather Post MK II BBS: 613-389-8315.

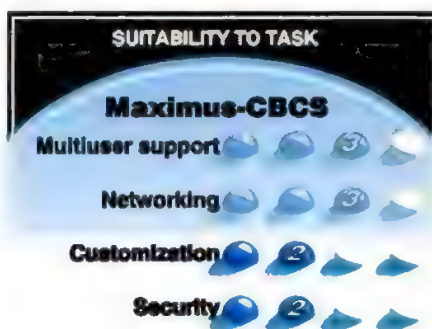
List Price: No charge for noncommercial use; commercial license, \$110 per node; site licenses available.

Requires: DOS version: 256K RAM, 30MB hard disk, DOS 3.x or later. OS/2 version: 3MB RAM, 30MB hard disk, OS/2 1.10 or later.

In Short: The only BBS in this review that supports multiuser functionality and networking under OS/2 as well as DOS, *Maximus-CBCS* also allows OS/2 sysops to set it up on a nondedicated PC and run it in the background. Reconfiguring the system is somewhat complex, and BBSs with a large message base may need a fast hard disk to avoid slowdowns in the current DOS version.

CIRCLE 416 ON READER SERVICE CARD

CONNECTIVITY BBS SOFTWARE



And Dudley's C source code, originally written for DOS, inspired an enterprising programmer named Peter Fitzsimmons to port it to OS/2. The OS/2 version requires OS/2 1.10 or later.

If you need to run a multiuser BBS on a nondedicated PC, *Maximus* offers a solution. The DOS version requires a multitasker or a LAN to support multiple users. Whether you use the DOS or OS/2 version, you have to run a front-end program to answer incoming calls. One option to consider is the OS/2 or DOS version of the *BinkleyTerm* front end, a free program you can download from Dudley's BBS. Or you might choose *Minimus*, a free third-party program available from Dudley or any of the *Maximus* distribution points that does nothing more than answer the phone and pass control to the BBS.

From the user's perspective, the DOS and OS/2 versions basically share the same interface and functionality, except the OS/2 version lacks support for the *DSZ* and *BiModem* external protocols. The sysop will notice only a few variations in command line options and the basic difference between how DOS and OS/2 software runs. *Maximus* provides a separate OS/2 Presentation Manager utility called *PMSnoop* that allows the sysop to monitor activity as the BBS runs in the background. This security feature works as promised, but it's not available under the DOS version.

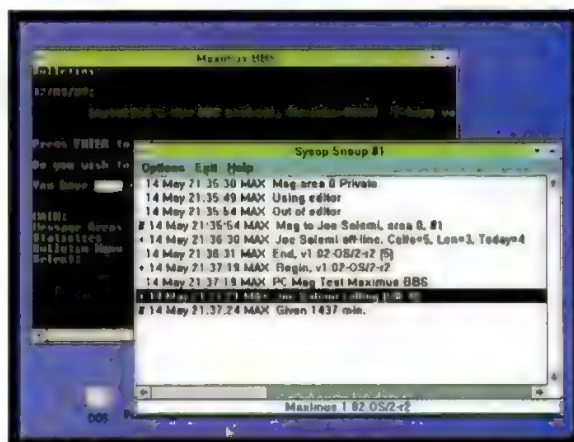
MULTISTEP SETUP

Installing *Maximus* is a multistep process. After you unpack the archive files onto a 30MB or larger hard disk, an install program automatically sets up the proper

subdirectories and provides a basic configuration for the DOS version. To run it under OS/2 instead, you simply replace the DOS executable with the OS/2 executable.

Modifying the basic configuration for either version of *Maximus* is complex, since the package includes no full-screen configuration utility. The three configuration files that control system parameters, message areas, and file areas are ASCII text that you must modify with a text editor. After making the changes, you run the files through the compiler program provided to create the binary files that *Maximus* uses. You do the same to customize the user menus and information files.

The program stores messages as individual files in subdirectories that correspond to each message group. You set up these subdirectories separately—a procedure that has the disadvantage of using a



In its OS/2 version, *Maximus-CBCS* performs best when run as an icon. The package includes the *PMSnoop* Presentation Manager utility, which lets the sysop monitor activity while the BBS runs in the background.

lot of disk space, as well as potentially causing performance problems when the number of messages is large. For this reason, the programmers recommend that the BBS be run off a drive partitioned and formatted under OS/2 1.20 or 1.30 HPFS (High Performance File System). For DOS users, the only solution for performance problems is a fast hard disk. The *Maximus* people say this issue will be addressed in the next release.

The software can also slow down when the host writes to the screen in an OS/2 window, potentially causing problems with file transfers at speeds above 9.6

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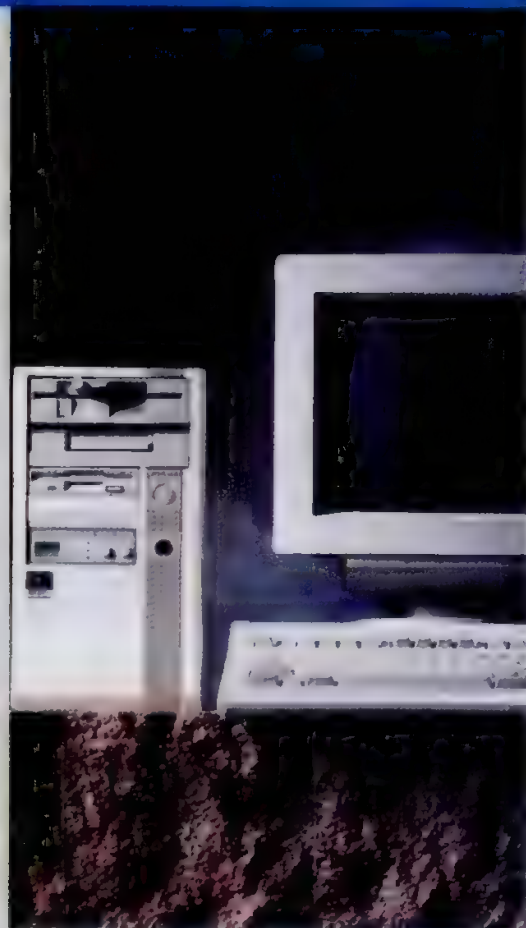
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PCM1591

CONNECTIVITY

BBS SOFTWARE

Kbps. The documentation recommends that the BBS be run as an icon to improve performance.

THE OS/2 ADVANTAGE

Maximus for OS/2 takes full advantage of OS/2's interprocess communications, however. The BBS can run on a workstation on a *LAN Manager* network, and users can access it through modems attached to a file or peer server. By using a dynamic link library for its communications routines, the *Maximus* BBS runs very well in the background and causes minimum impact on other tasks running on the system.

Two documentation files come with the basic software: a general guide to setting up the BBS and a detailed, indexed technical reference manual. Additional documentation for the OS/2 software describes differences between the two versions and supplements the information on how to set up a multiuser system. If you have any questions, support for *Maximus* is available via the authors' BBS, other *Maximus* sysops, and through a FidoNet echo, but there is no telephone support hotline.

By using OS/2's native multitasking capabilities, *Maximus-CBCS* offers an excellent choice for those who want to set up a multiuser BBS without having to dedicate a PC. You can run applications in other OS/2 sessions, even while users dial into your BBS and transfer files. The program has no limit on the number of users; users do not have to be running OS/2 themselves. For those who want to build a networkable, multiuser BBS under OS/2, it's the only choice available, although DOS users will find more functionality in some competing products than in the DOS version of *Maximus*.

Oracomm-Plus, Version 5N26

Of all the BBS software in this review, Surf Computer Services' *Oracomm-Plus* is unique in two respects: It is the only one that has built-in network capabilities, and it takes a very different approach to message handling by stringing replies seamlessly onto the original comment. Surf sells the *Oracomm-Plus* program in prices ranging from \$290 for 3 users to \$990 for 33 users. It's also available in a shareware version for a \$59 registration fee; it can

FACT FILE

Oracomm-Plus, Version 5N26
Surf Computer Services Inc., 71-540 Gardess Rd., Rancho Mirage, CA 92270; 619-346-9430. Oracomm Central BBS: 619-346-1608.
List Price: 3-user version, \$290; 10-user version, \$540; 17-user version, \$690; 33-user version, \$990; 2-line, 3-user shareware version, \$59 registration fee. Single-user version downloadable from many BBSs.
Requires: 640K RAM, hard disk, DOS 3.0 or higher. 286 machine or later recommended for four users or more.
In Short: A powerful, native multiuser BBS package with built-in network support and strong user-support abilities, *Oracomm-Plus* makes it easy to send messages across an organization.

CIRCLE 417 ON READER SERVICE CARD

be downloaded from the company's own bulletin board, Oracomm Central, at 619-346-1608.

Oracomm offers native support for multiple users. It can support up to 3 users on any system, up to 16 on a 286, and up to 32 on a 386, along with an extra local channel for the sysop's use. Using more than two dial-in lines requires that one or more Digiboard multiport boards be installed.

The program's security features are pretty tight, with up to 32,000 security levels, and good user accounting features. Third-party and external utility support for FidoNet and PCRelay networking is available for *Oracomm*. The program also offers a built-in proprietary network facility called Oralink.

Each *Oracomm* BBS has a unique node number hard-coded into the software and has the ability to share messages, mail, and files with other *Oracomm* boards without going through FidoNet and PCRelay. Transfers between different nodes go through one of the attached dial-up lines and can take place while other lines are active with users.

WIDE-AREA CONFERENCING

Oracomm also provides a real-time conferencing facility similar to the one found in *The Major BBS*. It supports public and private real-time chats between two or

more users on the same BBS. You can also use Oralink to set up one or more permanent links between two *Oracomm* systems, allowing a real-time conference to take place across different BBSs. This dial-out ability also lets *Oracomm* simulate doors, which it calls Outside Facilities. By linking an *Oracomm* BBS via direct-connect or modem to a non-BBS system, like a standalone PC, a minicomputer, or a mainframe, users of the BBS can transparently access programs running on the other system.

Installing *Oracomm* is simple. You run two self-extracting archive files that automatically unpack the software and create the proper subdirectories. The indexed manual is fairly easy to follow, and even inexperienced sysops can have the system up and running quickly. The manual contains full details on configuring and customizing the system, including initialization information for a number of modems. The company offers technical support by phone from 9:00 to 5:00 P.S.T. Monday through Friday (the call is not toll-free), and 24-hour support via the Surf BBS. Once you have the program up and running, it requires very little maintenance.

In *Oracomm*'s default user interface, the file sections and message sections are available from the main menu and are easy to find. As with most other packages, you can freely customize the interface. The package includes a limited selection of protocols. Only Xmodem and Ymodem come standard, although Zmodem support is planned for a future *Oracomm* release.

POWERFUL MESSAGE ABILITIES

Instead of using a separate message slot and header for every message and reply, *Oracomm* maintains an ongoing conversation within a slot. A user comments on a previous message by directly adding his or her message text to the end of it. When

SUITABILITY TO TASK

Oracomm-Plus

Multuser support

Networking

Customization

Security

CONNECTIVITY BBS SOFTWARE

a message slot is full, the software automatically creates a new one, continuing the discussion in a seamless, easy-to-follow thread.

MATCHING QUESTIONS AND ANSWERS

OraComm has a powerful facility called Match Questionnaire. It lets you completely customize sign-up questionnaires, customer surveys, on-line order-taking, and so on. The software also gives users the ability to match answers, making it easy to derive statistics from their questions or find other users with similar answers and interests.

Another interesting feature is called Text-Branching. You create a series of text messages that direct users to step through various screens of information and follow logical branches based on their input. You can use this facility to create on-line tutorials (a tutorial on using *Ora-*

PCBoard, Version 14.5

First released in 1985, *PCBoard* has grown to become one of the most widely used DOS-based BBSs. Designed primarily for business use, the wide range of features in Clark Development's BBS program makes it capable of handling many different message and file-transfer situations. Prices for the package start at \$120 for a single-user system without doors and range from \$240 for a 3-user system with doors to \$970 for a 99-user system with doors.

PCBoard is designed to allow even novice sysops to get a system up and running with a minimum of hassle. An auto-

ated program sets up the BBS in an immediately usable default configuration that requires 1.5MB of disk space. The default configuration displays all available menu commands on the main menu, but you can modify the menu by moving some functions to sub-menus. You make most modifications through the program's various text files, questionnaires, and doors. The large bound manual contains a wealth of information on configuring and customizing the BBS, and the *PCBModem* utility included with the system automatically configures a number of different modems for use with *PCBoard*.

You can establish message groups and file areas and set the security levels for the various menu functions. *PCBoard*'s security functions are limited to 255 access levels, although it provides support for completely private, password-protected message and file areas.

ABUNDANT MESSAGE AND FILE AREAS

PCBoard supports 65,000 different message and file areas. For this reason, Clark Development recommends that you use a LAN for multiuser operations instead of a DOS multitasker such as *DESQview*. The manual contains only minimal information for setting up the system under a multitasker.

PCBoard supports user-to-user private



FACT FILE

EDITORS' CHOICE

PCBoard, Version 14.5

Clark Development
Co., 3950 S. 700
East, #303, Murray,
UT 84107-2173;
800-356-1686, 801-
261-1686

List Price: 1-user
version, \$170; 3-
user version, \$240;
6-user version, \$350;
9-user version, \$460; 99-user version, \$970;
1-user version without doors, \$120.
Requires: 320K RAM, hard disk, DOS 3.1 or
higher.

In Short: An easy system to set up, *PCBoard* has excellent support for multiple dial-in or local users. It was specially designed for the extensive PCRelay network and is now one of the most popular BBSs. Its ability to set up a large number of message and file areas demonstrates its business-oriented design. The program includes several user- and file-management utilities.

CIRCLE 418 ON READER SERVICE CARD



PCBoard



The *OraComm-Plus* screen provides basic system monitoring with the ability to view user activity on any of the active lines.

OraComm-Plus is one of the few products we reviewed that has built-in multiuser support; it makes public and private real-time chats between two or more users on the same BBS possible.

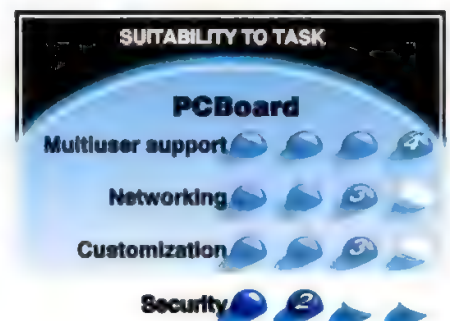
comm is included with the software), or a series of information screens for technical support.

OraComm's Text-Branching feature can help customers or people working for your organization solve a problem like installing a disk drive, while Match Questionnaires can aid in finding consultants or specialists. *OraComm-Plus* works well as a replacement for groupware packages, and its built-in network ability simplifies setting up an in-house network between the local and remote offices in your company.

or group chatting between nodes. It has a number of built-in file transfer protocols but does not include Zmodem. Nevertheless, you'll find complete information on adding external support, such as the *DSZ* Zmodem module, in the manual.

Setting up additional nodes is simple. You just move a couple of configuration files to a node-specific directory, then run *PCBSetup*, a full-screen configuration program that lets you change the node number in the separate configuration files.

The package includes two full-screen utilities for managing users and file areas: The first, *PCBSysMgr* (*PCBSM*), can examine, modify, and generate reports on user accounts. One of its options lets you print a report detailing the system's configuration; another lets you modify the default system's colors. The second utility, *PCBFile*, allows complete management of the file areas. It can scan for duplicate or missing files, sort the down-



Quick, do you know
the first name
in microprocessors?

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loaded file directories, and move files from one area to another.

Another program, called PCBMONI, lets you monitor the activity on all active nodes from a central location. You can run PCBMONI from anywhere on the LAN and monitor the BBS even if all nodes are busy. *PCBoard*'s built-in support for direct local log-ons makes it easy to set up and use the program as a central messaging system on a LAN.

PCRELAY SPECIALIST

Third-party utilities provide *PCBoard* with support for BBS networks. FidoNet utilities are available, but the primary networking is through PCRelay. Since PCRelay was originally designed for *PCBoard* (see the sidebar "FidoNet and PCRelay: Technologies for Networking



PCBoard's main screen provides password-protected access to all sysop functions. The PCBSysMgr utility is a boon to sysops; it helps them manage users by providing reports on user configurations and a way to modify user accounts. PCBMONI lets sysops monitor all active nodes from a central location.

Your BBS"), setting up a private network using this software is a straightforward operation.

Support for *PCBoard* is free for one year and available as an extra-cost option after that. Support is offered through Clark Development's Salt Air BBS and over the phone (8:00 to 5:00 weekdays, M.S.T.). Upgrades to new versions, or to a version supporting a larger number of simultaneous users, also cost extra. But Clark Development gives discounts off the full purchase price of the new package for those who have purchased the support option.

PCBoard's extensive message and file-

CONNECTIVITY BBS SOFTWARE

area capabilities make it an excellent choice for wide-area product support or in-house messaging and conferencing. With easy setup that makes it a cinch for even novice users to install, you won't regret selecting this program for your bulletin board system.

RBBS-PC, Version 17.3b

The best way to describe *RBBS-PC* by Tom Mack, Ken Goosens, and Doug Azzarito is "venerable." Originally released in the summer of 1982, it was the very first DOS-based PC BBS, running

under the BASIC interpreter supplied with every IBM PC. It has always been copy-righted but free for the downloading, and the source code, now compiled, has been available since the beginning. The current version is the result of the efforts and modifications of many *RBBS* sysops over the years. Disks and documentation can be obtained from the Capital PC User Group Software Library (\$16) or from Technology Consult-

ants (\$10). It is also available on Compu-Serve and from BBSs too numerous to count. Among the BBSs it can be downloaded from are Mack's, Goosens' and Azzarito's own, at 203-268-5315, 703-978-6360, and 407-627-6969, respectively.

RBBS-PC is distributed in a number of .ZIP files and includes a large manual that explains the many functions and capabilities of the software in great detail. Even if you do not intend to run an *RBBS* system, the manual is worth obtaining and reading as a tutorial and guide to proper BBS design. Installation is easy; once you decompress the files into a subdirectory on a recommended 20MB or larger hard disk, an installation program creates all the necessary subdirectories for storing the system, message, and text files.

EXTENSIVE LAN SUPPORT

The supplied configuration utility steps you through the 327 different configuration parameters, each thoroughly ex-

FACT FILE EDITORS' CHOICE

RBBS-PC, Version 17.3b

Capital PC User Group Software Library, P.O. Box 1785, W. Bethesda, MD 20827-1785; 301-762-6775; PC-HOST BBS 301-949 8848

Technology Consultants Inc., P.O. Box 811985, Boca Raton, FL 33481-1985, Technology Consultants BBS: 407-627-6969

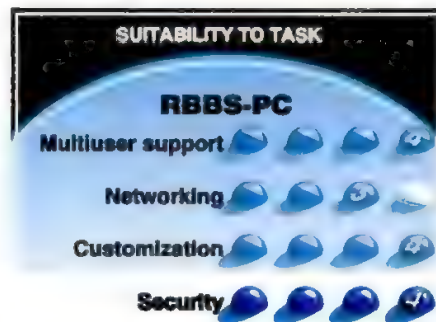
List Price: No charge to download, disks with code, documentation, utilities, and instruction, \$16 from Capital PC User Group Software Library or \$10 from Technology Consultants.

Requires: 512K RAM, 20MB hard disk, DOS 2.1 or higher.

In Short: The original BBS for IBM PCs, *RBBS-PC* is still a standard by which all others are judged. The source code is available; although free, the program is not in the public domain. *RBBS-PC*'s hallmarks include strong security features, a highly customizable interface, excellent manuals, special voice-synthesis capabilities for sight-impaired sysops, a fast file-search facility, strong support for doors, and a large proprietary network.

CIRCLE 419 ON READER SERVICE CARD

plained in the manual. Appendixes explain modem initialization strings for many different types of modems and include information on setting up the software on a large variety of DOS multi-tasking systems including *DESQview* and *Windows 3.0* and LANs such as Corvus's *PC/NOS*, DCA's *IONET*, and *PCNet*, from Orchid or AST. There is also a generic NetBIOS network category, but not specifics for setting the BBS up under *LAN Manager* or *VINES*. Neither does it have specific information for *NetWare*. Once you're sure the system is running properly in single-user mode, it's easy to set up *RBBS* for multiple users. Technical support, if needed, is always available through a number of BBSs scattered across the



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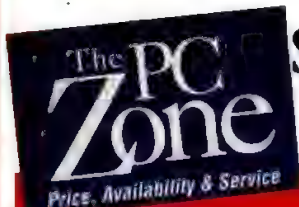
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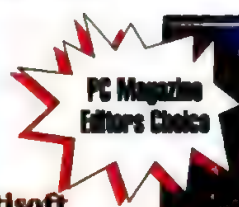


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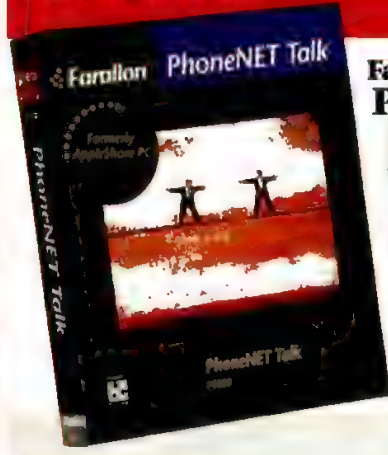
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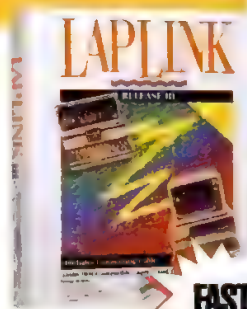
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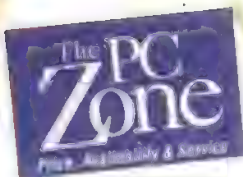
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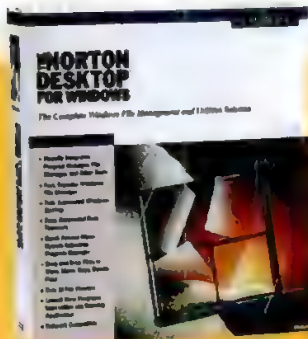
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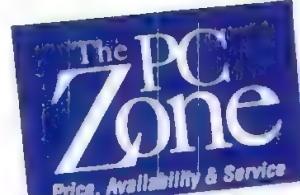
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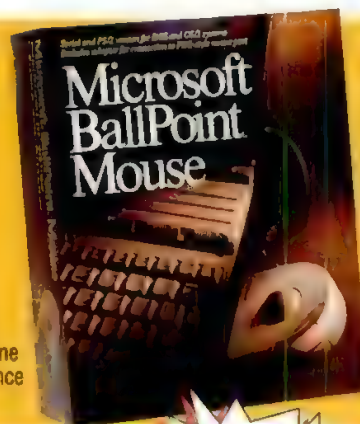
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Despite its age, *RBBS* has kept up with advances in BBS software and has a number of features that make it a highly customizable system. You can modify the user interface to make the BBS as simple or complex as you like. The main menu governs access to the main message base, conferences, bulletins, submenus, and

consists entirely of *RBBS* systems, a sign of how effective *RBBS*'s network capabilities can be.

A unique feature of *RBBS* is its built-in support for sight-impaired sysops. You can configure the software to play a different musical tune on the PC's speaker, depending on what the on-line user is doing at any particular moment. The software will also interface with a number of different speech cards; the voice synthesizers continuously advise the sysop of the entries that are being made into the caller log.

Another good feature of *RBBS* is its support for CD-ROM drives. It includes a fast file-search facility that compensates for the generally slow access times of

CD-ROM drives, making it practical to offer a large number of files for users. *RBBS* also supplies strong support for doors. You can use the door feature to give users access to *dBASE* and *Oracle* databases, or set up a system to support on-line searches of technical databases or sales records.

With its wealth of features, excellent manuals, and the minimal investment of money and time needed to get up and running, *RBBS-PC* is one of the best choices for those who want to explore the capabilities that a BBS can provide.

RemoteAccess, Version 1.01

RemoteAccess is one of the most customizable BBS packages available, allowing you to set a wide range of security levels, menu interfaces, and configurations. Developed by Continental Software in Australia, the system is available as shareware in the U.S. via either its distributor (the Augusta Forum BBS at 803-279-4124), CompuServe, or a wide range of other BBSs. Originally written as a solution to the problem of setting up a compatible *QBBS* (QuickBBS) system for multiple users, the licensing fees of this shareware program depend on how you intend to use the system. For noncommercial or private use, registration costs \$50.

SUITABILITY TO TASK

RemoteAccess

Multiuser support

Networking

Customization

Security

A commercial license costs \$120 if you don't use the BBS for profit; \$265 if you do. All versions support 99 users.

You manually install *RemoteAccess* from a .ZIP file. The on-disk manual gives full instructions for setting up the proper subdirectories and moving files to them. You then run a configuration utility, *RACONFIG*, that sets up the BBS itself.

RACONFIG is a full-screen application that lets you establish the various message groups and file areas (up to 200 of each), and set security levels and other system parameters. You can designate a message base to be for public and private messages, public-only, private-only, or read-only.

RemoteAccess supports more than 64,000 access levels and provides a set of 32 access flags that control user access to particular message or file areas. Other system controls let you prevent down-

RBBS-PC version 17.30		HOME 1		Date 05-13-91 Time 10:56	
KEY	ACTION	KEY	ACTION	SYSTEM STATUS	
F1	Edit RBBS-PC	UP	Raise security by 1	PWS Active	YES
F2	Shell to DOS	DOWN	Lower security by 1	Extended Logging	YES
F3	Printer Toggle	LEFT	Lower time by 1 min	POBIL Support	No
F4	Sysop Toggle	RIGHT	Raise time by 1 min	Communication Port	COM1
F5	Force Caller Online	CTRL	Use 5 for above	BASIC 80 Programs	20h
F6	Sysop Availability	PCMN	Display user profile	Waiting for BNC	1
F7	Sysop on Hunt	PCMN	Remove user profile	Ready for Calls	YES
F8	Temporary Sysop	DND	Hang-up caller		
F9	Sysop Toggle	END	Lock out caller		
F10	Chat with User	ESC	Local Logon	Setup	No

Its main screen may not be much to look at, but when it comes to features, *RBBS-PC* packs quite a punch. The sysop can monitor users with functions that include the ability to lock out or hang up on callers, chat with users, and raise or lower security levels. Built-in support for sight-impaired sysops and a fast file-search utility further enhance this standard-bearing product.

system utilities such as paging the sysop. The submenus govern file transfers, user configuration utilities that allow the user to change his or her defaults, and access to doors. Each conference also has its own main menu, with just about the same functions as the top menu, since each conference is like a kind of sub-board of the main board.

STRONG SECURITY

RBBS's security functions put it in the top five systems for protection against unauthorized access. *RBBS* has 65,536 different access levels; every system function has a security level attached to it, and a user must have that level or higher to be able to use that function.

You can easily network the software through either FidoNet or PCRelay by using a number of third-party support utilities, allowing you to exchange e-mail with other users on these networks. One of the larger public BBS networks based on FidoNet technology is *RBBS-Net*. It

FACT FILE

RemoteAccess, Version 1.01

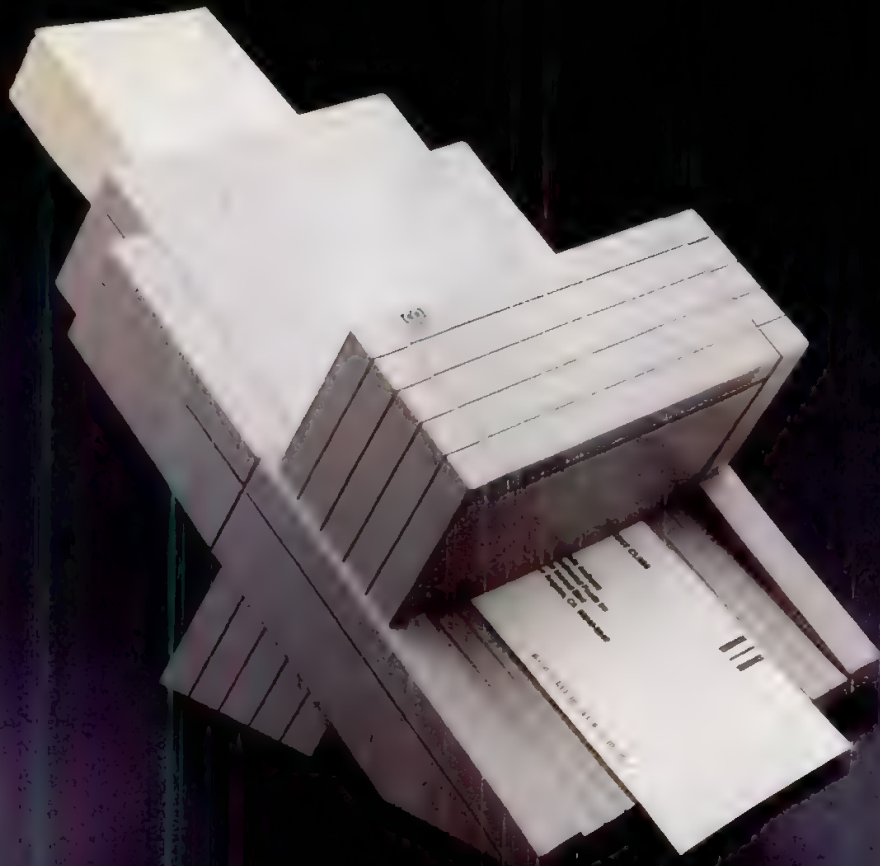
Continental Software, c/o Milner International College, 195 Adelaide Terr., Perth, Australia, 6000. *RemoteAccess* Support "USA" BBS, American on-line contact: 918-254-6618.

List Price: For 99 users: noncommercial/private use, \$50 registration fee; Commercial/1 (not used for profit), \$120 registration fee; Commercial/2 (used for profit), \$265 registration fee.

Requires: 190K RAM, hard disk, DOS 3.1 or later, FOSSIL driver.

In Short: A highly customizable BBS package, *RemoteAccess* may be confusing to the novice sysop. But it lets you set an extremely wide range of security levels, configurations, and menu interfaces, including ANSI graphics menus, to create the look and feel you want for your system. Multiuser setup is straightforward.

CIRCLE 420 ON READER SERVICE CARD



Actual size: 8.7" x 8.5" x 8" (HWD)

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CIRCLE 166 ON READER SERVICE CARD

*Windows application support in 4th quarter 1991. Macintosh software is included. 220/240v model also available.
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CONNECTIVITY BBS SOFTWARE

loads during certain hours by all users, or only by those dialing in at less than a specified bit-per-second rate.

HIGHLY CUSTOMIZABLE INTERFACE

The program includes 62 different menu parameters and a set of default menus that you can modify with a special utility. The main default menu gives access to the message, file, door, and user-parameter areas. But as with any BBS package, you'll probably want to customize it right away; you can display your own ASCII text or ANSI graphics menus in place of the default menus. You can even choose not to display some menu selection keys on-screen, while allowing them to remain active. This feature gives you a wide latitude in creating the look and feel of the system.

RemoteAccess is FidoNet-aware, which means that it has some features that make it easier to hook into a FidoNet

tively straightforward. You run RACONFIG to turn on the multiuser parameter, then create a separate subdirectory for each incoming line, or node. You don't need to copy any files to the individual subdirectories; *RemoteAccess* uses subdirectories for storing temporary files and node-specific log files. Instead of looking for configuration files in the subdirectories, it passes the particular node number to the BBS via a command line parameter at startup time.

RemoteAccess also supports direct local log-ons. Combine this with passing the node number on the command line, and it's very easy to set up the BBS as a message system for local and remote LAN users. Xmodem, Ymodem, and their -G variations, along with Zmodem, are built in, and the software supports up to 15 external file-transfer protocols.

The manual lists a number of bulletin boards that offer support, and you can also find help through a FidoNet echo. On-line support can also be obtained via *RemoteAccess* Support *USA* at (918) 254-6618. Upgrades to the software are free and are available for downloading from any of the support boards, and usually from other *RemoteAccess* systems.

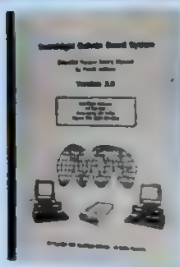
With its minimal default menus and large number of configuration parameters and menu functions, setting up a *RemoteAccess* system can be a daunting task for the novice sysop. Nevertheless, the program's built-in support for multiple users, wide variety of message functions, and excellent security make it a good choice for those who don't mind spending the time to set it up right.

Searchlight, Version 2.15

Searchlight Software's *Searchlight* has not only the flexibility to set up a wide variety of message and file areas but also has a user interface that resembles no other in this review. The program has a registration fee of \$49 in its single-user shareware version and costs \$119 in a

FACT FILE

Searchlight, Version 2.15
Searchlight Software, P.O. Box 640, Stony Brook, NY 11790; 516-751-2966; Searchlight BBS: 516-751-2566.
List Price: 1-user shareware version, \$49 registration fee; 1-user extended commercial version, \$89; 99-user extended commercial version, \$119.
Requires: 170K RAM, hard disk, DOS 3.0 or later.
In Short: *Searchlight* stands out from the crowd with a unique user interface that displays one menu choice on-screen at a time, at a low cost for a large number of multiple users. The program supports message threading, which makes it easier to follow conversations.



CIRCLE 421 ON READER SERVICE CARD



Unlike most BBS programs, *RemoteAccess* requires the use of FOSSIL before it will run. The status line on the bottom of the screen stays active while a user is on-line, displaying details such as the last caller and the total number of system calls.

network. The software offers built-in support for sharing messages and private NetMail over FidoNet and supports a number of external mail and front-end programs. But even if you're not using it as part of a network, *RemoteAccess* requires the use of a FOSSIL (Fido/Opus/SeaDog Standard Interface Level) driver before it will run.

EASY MULTIUSER SETUP

The standard package comes with support for up to 99 simultaneous users. Setting up the BBS as a multiuser system is rela-

multiuser commercial package.

Installing *Searchlight* is a manual process. After unpacking the files, you run a configuration utility to establish your defaults, followed by a setup program to install the message and file areas. Setting up a multiuser system on a LAN or under a multitasker like *DESQview* or *Windows* 3.0 is simple. We set up a multiuser system in less than half an hour. The bound manual is easy to follow, although it lacks an index.

The multiuser version supports up to 99 simultaneous users, making *Searchlight* the least expensive commercial BBS package for large installations. The software also ranks among the most compact, taking up approximately 800K of disk space. Each additional node requires only another 7K for its control file.

UNUSUAL MENU INTERFACE

Searchlight features a unique default user menu. Instead of a full-screen menu listing all the available options, choices ap-

SUITABILITY TO TASK

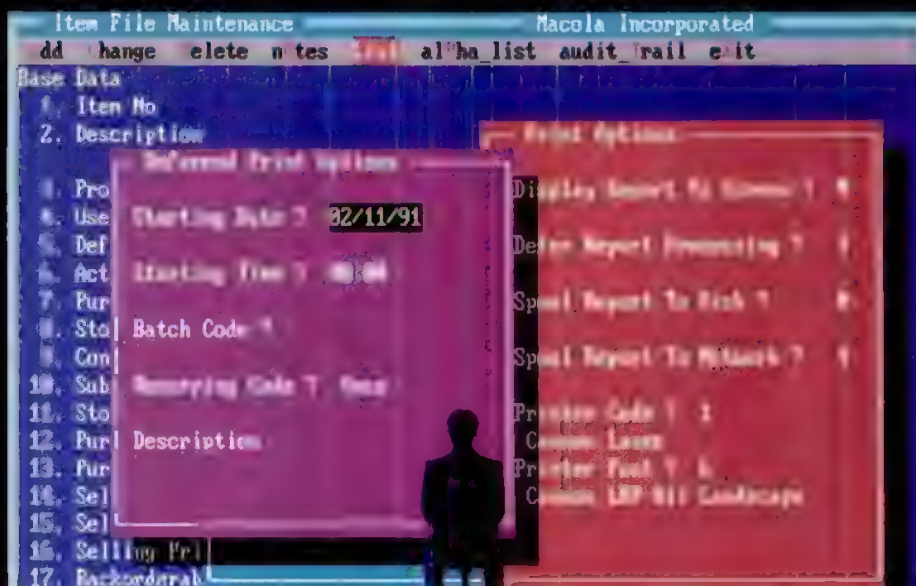
Searchlight

Multitasker support 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Networking 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Customization 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Security 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100



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BBS SOFTWARE: SUMMARY OF FEATURES

Products listed in alphabetical order

Maximum number of message groups refers to the total number of private and public message groups (areas) possible. The more message groups allowed, the more topics, or discussions, a BBS can have.

Maximum number of file areas refers to the number of separate areas where files of a like nature can be kept for downloading. Administratively, having separate areas for *Windows*, *DOS*, and *OS/2* files can make keeping track of them easier.

Message storage There are two ways that BBS messages can be stored on a disk. By having them all in one file, you are maintaining a single "database" of messages, which can be indexed for efficient retrieval. Message storage in individual files consumes more disk space.

Bulletin files are text files that contain information about the sysop, rules, and other features of the bulletin board system.

Customization options for sysop means that the sysop can make adjustments to the menus the user will see, in terms of both content and sequence. *The Major BBS* and *PCBoard* allow the sysop to change the access level of each menu item, which changes the list of actions the user can see and do, but these programs do not allow the sysop to alter the appearance of the menus.

Number of menu functions refers to the number of functions the sysop can set up for the user to see.

A native multitasking product can support **doors to external programs** without being able to shell and execute or swap to *DOS*, as these multitasking programs use *DOS* only to load the BBS initially. These pro-

grams have a non-*DOS* means of executing exterior files. Some boards do not provide doors from within the BBS package; instead, they exit the BBS completely and return to the calling batch file, which then calls the door program. When the door program has finished executing, the batch file recycles to the top and reexecutes the BBS software.

Shell and execute means that you can run an external program while the main program remains in RAM. That means the external program has less RAM available to use. If the BBS can **swap to DOS and execute**, it leaves only a small portion of itself behind in RAM, leaving more RAM free for the external program.

Hotkeys, in the BBS world, let you select a choice on the menu by typing a corresponding letter or number, without having to hit *Return*.

List price
(minimum number of nodes)

The Major BBS
2 users:
standard,
\$59.00; Super
Combo, \$829.00.

Maximus-CBCS
Commercial,
\$110.00 per
node;
nonprofit,
no charge.

Oracomm-Plus
3 users,
\$290.00.

PCBoard
3 users,
\$240.00.

RBBS-PC
No charge
when
downloaded.

List price
(maximum number of nodes)

256 users:
standard,
\$3,359.00;
Super Combo,
\$4,129.00

As above

33 users,
\$990.00.

99 users,
\$970.00.

As above

GENERAL FEATURES

Maximum number of message groups	Limited by disk space	1,296	99	65,000	Limited by disk space
Maximum number of file areas	Limited by disk space	1,296	3,456	65,000	10,198
Message storage	All in one file	Individual files	All in one file	All in one file	All in one file
Bulletin files:					
Forces user to read modified files	■	■	■	■	■
Gives user the option of reading modified files	□	□	□	□	□
One-time-only display	□	□	□	■	■
Customization options for sysop	□	■	■	□	■
Number of menu functions	More than 40	127	Unlimited	40	39
Supports ANSI/Color menus	■	■	■	■	■

■ — Editors' Choice

■ — Yes

□ — No

N/A — Not applicable: The product does not have this feature.

Private messages are messages that only the sender and receiver (and usually the sysop) can read.

Private message areas have access limited to certain BBS users.

Automatic user accounting means that the sysop can set up a user account that automatically expires after a certain amount of time. This is handy for bulletin boards available by subscription, or for those that operate as tech support for users whose contracts are renewable yearly.

LAN support means that the BBS can use a LAN to provide multiuser capabilities and to be accessed by a user from another workstation on the LAN. If the product has this feature, it will apply on all the major LANs, such as *LAN Manager*, *NetWare*, and *VINES*, and even DOS-

based LANs. This goes beyond our review criteria, which specified that the packages had to be able to run on a workstation attached to a LAN and use the LAN's file server for data storage.

Questionnaires is the usual term for surveys in the BBS world. All the packages we reviewed support them.

Access levels All the products let the sysop set different access levels for reading and writing or uploading and downloading. This gives the sysop greater control over who can do what; a new user can call in and read some of the messages, but cannot respond to them or enter his own until his access level is upgraded. This feature is helpful for a support BBS, where the vendor may want to make sure that the caller is actually a registered product user before answering any questions.

pear as full words in the same place on-screen. Users see only one choice at a time, unless as administrator you decide to design a full-screen menu for display. A help line with informative text on each menu choice appears on the line below. The user can scroll through the choices using the arrow keys and hit Enter to activate the currently displayed command, or type the first letter of the command to execute it immediately. Each menu item can have a particular security access level; the program supports over 6,600 levels. You can also modify the default menu by creating your own ASCII or ANSI menu files from scratch, but the manual contains little information on how to do this.

The *Searchlight* message databases support message threading, allowing users to follow a chain of messages and replies on the same subject without having to jump from subject to subject while reading them.

The Searchlight

message databases

support message

threading.

Each node in a multiuser system can run in dedicated mode for dialing in or in local mode for use by LAN users. *Searchlight* comes with a utility for importing and exporting messages in the FidoNet format, but you need to use an external mail-packing utility and front-door program to make it fully FidoNet-compatible. Utilities are also available for interfacing *Searchlight* with PCRelay networks.

FILE-LEVEL PASSWORD PROTECTION

The software supplies only three internal file-transfer protocols and does not include Zmodem; however, it lets you add nine external protocols, like *DSZ*'s Zmodem. You can password-protect files to ensure that only users who know the password can download them.

The author's BBS (also called *Searchlight*), CompuServe, and a number of affiliated BBSs around the world provide support for *Searchlight*. Direct telephone

RemoteAccess	Searchlight	Spitfire	TBBS	Wildcat!
99 users: commercial, \$250.00; non-profit, \$120.00; noncommercial, \$50.00.	1 user, \$89.00.	255 users, \$70.00.	1 user, \$299.95.	1 user, \$129.00.
As above	99 users, \$119.00.	As above	32 users, \$1,495.00.	250 users, \$499.00.
200	Limited by disk space	255	63	1,000
200	Limited by disk space	255	255	1,000
All in one file	All in one file	All in one file	All in one file	All in one file
☐	☐	■	■	■
■	■	☐	☐	☐
■	☐	■	■	■
■	■	■	■	■
62	46	More than 40	40	39
■	■	■	■	■

CONTINUES

Wrong.

“ you need look no further than *FoxPro*, Version 1.02.

This \$795 database from Fox Software has succeeded *dBASE* as the industry leader in innovation, power, and speed—a winning combination.”

—PC Magazine 5/28/91

Write.

Don't get us wrong—we love the quote. And *FoxPro* 1.02 really was that good.

But we've just released *FoxPro* 2.0. And it's more innovative, more powerful, and far, far faster.

You'll have to write (or call) for details, but here are some of the highlights:

In tests against IBM's DB2 on a mainframe, *FoxPro* on a PC was 4 times faster querying a million-record, 200 megabyte database.

And against other PC database management systems like *dBASE* and *Paradox*, it's devastating, thanks to our patent-pending *Rushmore™* query optimization techniques.

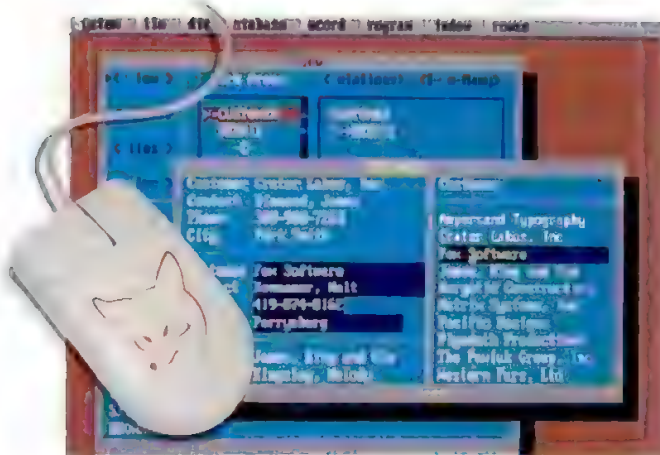


The DBMS that acts like a Mac and runs like a mainframe. In DOS.

On top of its state-of-the-database-art performance, *FoxPro* 2.0 with its CUA-like interface gives you the ease-of-use of a Graphic User Interface (GUI) on your character-based DOS PCs.

You use pulldown menus to open multiple windows you scroll through, reposition and resize using keyboard shortcuts or a mouse.

Our Fourth Generation Language (4GL) tools make screens, menus, reports and labels a snap. Create your own custom data entry and viewing screens just by picking-and-clicking to position data, buttons, check boxes and scrolling lists



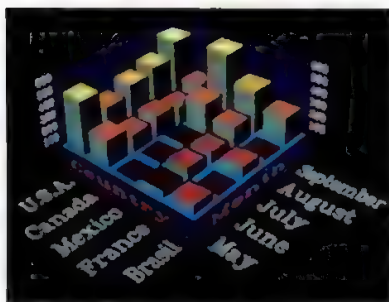
anywhere you want them. Then assemble everything into your own custom applications without writing a single line of programming code.

But that's only the tip of the iceberg.

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Our new compound indexes are as small as a quarter the size of those in competitive products and far, far faster.

Our new Relational Query-By-Example (RQBE) is a simple, interactive interface to the information you need. Unlike other query systems, RQBE lets you browse the answer table, or create an instant database, report, labels or a business graph (with our optional FoxGraph or other graphic program).



Behind its friendly exterior, RQBE creates an efficient SQL SELECT statement you can add seamlessly to any of your applications. And do the same with our new

SQL INSERT and CREATE TABLE commands, too.

We've added over a hundred new and enhanced commands and functions, including one-to-many-to-many relations, new array handling, and a BROWSE FOR command that could be the basis for an entire application itself.

We've added a new project manager that keeps track of all the needed files and any changes then automatically builds your applications (and EXE files with our optional Distribution

Kit). And an API (Application Program Interface) that lets you dynamically link to libraries written in C or assembler (Library Construction Kit optional) using a single FoxPro command.

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* Quote from Software Digest Ratings Report, Vol. 7, Issue 13 (Oct. 1990) refers to FoxPro 1.02. Software Digest is a registered trademark of NSTL, Inc. Prices valid only in U.S. and Canada. Upgrade offer is for Single-User Version only of FoxPro 2.0. FoxPro™ Fox Software, Inc.; other products and services are not. ©Fox Holdings Inc. 1991.

CONNECTIVITY
BBS SOFTWARE

BBS SOFTWARE: SUMMARY OF FEATURES

Products listed in alphabetical order

	The Major BBS	Maximus-CBCS	Oracomm-Plus	PCBoard	RBBS-PC
GENERAL FEATURES (CONT.)					
Doors to external programs	☐	☒	☒	☒	☒
Shell and execute	N/A	☒	☐	☒	☒
Swap to DOS and execute	N/A	☒	☐	☒	☒
Built-in expanded memory support	☐	☐	☒	☒	☐
Built-in extended memory support	☐	☒ (OS/2 only)	☒	☒	☐
FOSSIL driver required	☐	☒ (DOS only)	☐	☐	☐
Maximum rate (bits per second)	38,400	38,400	19,200	115,200	38,400
USER INTERFACE					
Hotkeys	☐	☒	☒	☐	☒
Full-screen message editor	Optional	☒	☐	☒	☐
Allows aliases	☒	☒	☐	☐	☐
Scans for new messages or files	☒	☒	☒	☒	☒
Allows chats with sysop	☒	☒	☒	☒	☒
Allows chats with callers on-line	☒	☒	☒	☒	☐
FILE-TRANSFER PROTOCOLS					
ASCII	☒	☐	☐	☒	☒
Xmodem	☒	☒	☒	☒	☒
1K-Xmodem	☒	☒	☒	☒	☒
1K-Xmodem-G	☐	☐	☐	☒	☐
Ymodem	☒	☐	☐	☒	☐
Ymodem batch	☒	☐	☒	☒	☐
Ymodem-G	☒	☐	☒	☒	☐
Zmodem	☒	☒	☒	☐	☐
Kermit	☒	☐	☐	☐	☐
Other internal protocol	☐	☒	☐	☐	☐
External protocol support	Optional	☒	☐	☒	☒
SECURITY					
Access levels	8	3,072	32,000	255	65,536
Forced password changes	☐	☐	☐	☐	☐
Private messages	☒	☒	☒	☒	☒
Private message areas	☒	☒	☒	☒	☒
Private file areas	☒	☒	☒	☒	☒
Automatic user accounting	☒	☐	☒	☒	☒
Phone-number check	☐	☐	☐	☐	☒
User name check	☐	☒	☒	☒	☒
Callback verification	Optional	☒	☐	☒	☒
MULTIUSER SUPPORT					
Native multiline/multiuser support	☒	☐	☒	☐	☐
DOS multitasker support	☐	☒	☐	☐	☐
OS/2 support	☐	☒	☐	☐	☐
LAN support	☐	☒	☐	☒	☒
BBS NETWORK SUPPORT					
FidoNet	☒	☒	☒	☒	☒
PCRelay	☐	☐	☒	☒	☒
Proprietary	☐	☐	☒	☐	☐

 —Editors' Choice

☒ —Yes

☐ —No

N/A—Not applicable: The product does not have this feature.

[illegible]

ENDS

PG

MAGAZINE

EDITORS' CHOICE

March 26, 1991

Zoom/Modem V.42bis

The Choice in High Speed Modems

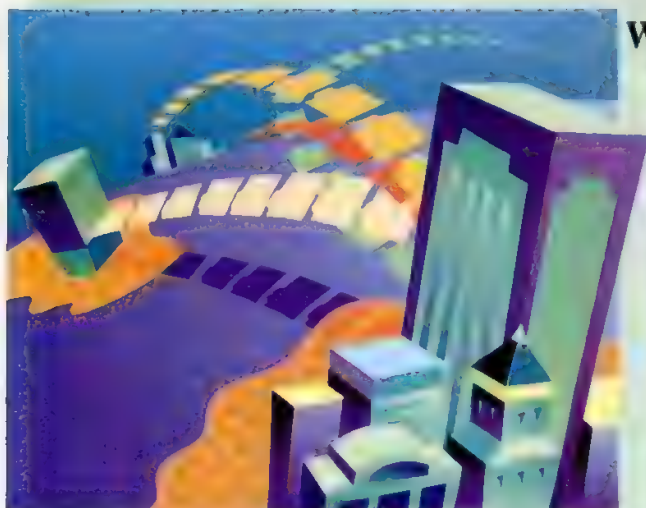
PC Magazine recognized the exceptional value of our Zoom/Modem V.42bis with one of the industry's top honors, the Editors' Choice.

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WAITS: Automating Wide-Area File Transfers

by Steve Rigney

Organizations with multiple locations face the challenge of exchanging information quickly, regularly, and automatically among sites. Using BBS software that supports Fidonet and PCRelay networking technologies is one very good way to meet that challenge. Since the Fidonet and PCRelay technologies are event-driven, it's easy to set up your network so that it shuts down to human callers four or five times a day and does nothing but transfer messages and files to other systems.

There are also more-specialized means to this end available. BBS software, oriented primarily toward human callers (as opposed to automated file transfers), gives them the ability to exchange messages and electronic mail, as well as files. But if you need to transmit files only—and do it regularly, several times a day—wide-area information transfer systems (WAITS) offers an alternative. WAITS are less concerned with the human element; the only way they can send mail and messages is as files.

However, if handling calls is not important to you (and you'd rather not go through the complexity of setting up a BBS and BBS network), the benefits of using unattended and fully automated WAITS grow rapidly as businesses expand and employees have less time to collect and distribute information. A WAITS network consists of PCs running software that lets them communicate and exchange files with

each other automatically. WAITS programs are single-purpose products that incorporate special management tools and, in some cases, support multitasking.

Large retail-oriented businesses usually have a central office housing the company's inventory, sales, and other data. Through the use of a WAITS, the outlying offices, operations, or

stores can exchange information with the corporate office at any time without monitoring the transfer. WAITS require only the use of a modem and a PC capable of running the software at each end. The solution usually proves more cost-effective than more hardware-intensive linking devices like bridges and routers. (For a full description of WAITS software, see "Wide Area Information Transfer Systems," *PC Magazine*, March 27, 1990.)

In the WAITS market, two products, SofNet's *XChange Plus* and XcelleNet's *XcelleNet*, lead the market and typify the levels of product available. They resemble one another in offering fully automated, unattended, wide-area information transfers. They differ in flexibility, price, and features. Two other packages, *BackMail II* from Alethic Software (Reading, Pennsylvania; 800-333-7582), and *tPost* from Coker Electronics (San Mateo, California; 415-573-5515) are in the same market and offer features similar to those of *XChange Plus*. *Backmail II* is priced at \$627 for a package that includes a hub and polling TSR; \$498 buys you the *PC-tPOST* remote and *tPOST* central software.

XCELLENET:

LARGE-SCALE HUB SETUP

XcelleNet is best suited for larger corporations with many operating locations. The *XcelleNet* software package costs \$219 per node for the remote software, and \$5,995 for a 50-node

host package. The central controlling computer, usually located in the corporate office, runs a program called *Network Manager* over the OS/2 Presentation Manager graphical interface. The central computer can operate up to 18 serial ports and communicate with the various local and remote nodes sending and receiving data. The *Network Manager* software provides automatic session scheduling in addition to data compression, error detection and correction, and a host of other features that allow for automatic and reliable data transfers. Obviously you need the dedicated resources of a high-powered PC to handle these multiple communications sessions.

On the remote side of the WAITS connection, you install XcelleNet's *X/Node* program on any IBM-compatible PC running DOS, OS/2, Xenix, or Unix. Operating as a TSR using 64K of the remote PC's RAM, *X/Node* transparently and automatically performs its communications functions while the PC runs other applications. The system administrator at the central computer can use *Network Manager* to connect to a remote PC at any time without disturbing the workstation's current operations.

XcelleNet works with any telecommunications carrier and supports different connection methods, including 800/WATS, X.25 packet networks, and VSAT satellite terminals.

XCHANGE PLUS:

NODE-TO-NODE WITH FAX

SofNet's *XChange Plus* is designed for smaller organizations needing WAITS service. Priced at \$199 per node, the *XChange Plus* package comes complete with the software needed to perform automated communications among remote PCs, facsimile machines, and internal fax boards.

XChange Plus is a DOS-based product compatible with *NetWare* or *NetBIOS* networks. Unlike *XcelleNet*, the *XChange Plus* package does not include different remote and central software programs to enable automatic

CONNECTIVITY BBS SOFTWARE

communications; a single program performs all functions. By using the same software at both ends of the WAITS link, *XChange Plus* avoids *XcelleNet*'s cumbersome star topology and allows a node to make connections to any node on the system without passing through a central hub. However, the *XChange Plus* software runs in the foreground and requires a dedicated PC.

The facsimile driver packaged with *XChange Plus* operates as a TSR in the background while the rest of the WAITS connection software works in the foreground of the host computer. *XChange Plus* also allows data transfer scheduling and data compression, plus error detection and correction.

XcelleNet and *XChange Plus* are two examples of innovative products in the distributed communications market. Because they're specialized, they can handle LAN-to-LAN information transfers efficiently without requiring customized program scripts. ■

XcelleNet Remote Applications Management System

XcelleNet Inc., 5 Concourse Pkwy., #200, Atlanta, GA 30328; 404-804-8100.

List Price: *X/Node* (remote): \$219 per node; *Network Manager* (central): \$5,995 to \$19,995 depending on the number of nodes.

Requires: Remote site: DOS, Windows 3.0, OS/2, Unix, Xenix, VMS, or 4864 point-of-sale; 8088-based PC or better, or PS/2; 640K RAM. Central site: 80386-based PC or better (dedicated station recommended), 7MB to 9MB RAM depending on number of nodes, 60MB hard disk, OS/2 1.2 or later.

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XChange Plus

SofNet Inc., 775 Franklin Rd., #101, Marietta, GA 30067; 404-499-0007.

List Price: \$199 per PC license.

Requires: 8088-based PC or later, 280K RAM, one or more disk drives (hard disk recommended), modem, fax board, DOS 3.0 or later.

CIRCLE 546 ON READER SERVICE CARD

support is available from 10:00 to 6:00 E.S.T. weekdays; the call is not toll-free. An annual \$45 support subscription from Searchlight Software entitles you to re-



Searchlight's sparse main BBS screen monitors activity only on the particular node on which it runs. Its user menu differs from the rest of the programs we reviewed in that users see only one menu choice at a time rather than a full-screen menu listing all available options, unless you decide otherwise. Arrow keys scroll through the choices.

ceive a series of free upgrades.

Searchlight's low-priced multiuser version makes it a cost-effective choice in businesses that need a wide-area conference system for their employees and customers. The program's unique user interface may or may not be to your tastes, but it certainly makes the program stand out from the crowd.

Spitfire, Version 3.0

The *Spitfire* BBS from Buffalo Creek Software is a good, basic BBS that contains few outstanding features and has one quirk in multiuser environments. But it delivers solid, dependable performance in an easy-to-use \$70 shareware package with support for 255 users. It can be downloaded from Buffalo Creek's BBS at 515-225-8496, CompuServe, and about 600 registered BBSs.

To install *Spitfire*, you unpack the distribution .ZIP file into the main system directory and edit the supplied SF.BAT file to support the bps rate and comm port

of your modem. You'll need a hard disk with at least a 20MB capacity. The first time you run the software, it creates all the necessary configuration files. While the system is idle, you can use Alt-key routines to configure the BBS further. The

Alt-key combinations are conveniently listed on a pop-up help screen.

ASCII MENU EDITING

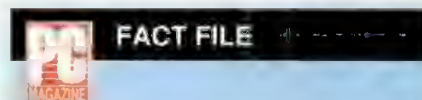
To change the default menus, you need to edit the .MNU files with an ASCII text editor; there is no full-screen menu editor included. You can set user access security to the BBS's various functions through the .MNU file. All you do is decide on the minimum security level needed to

access a particular function and list it on the same menu line as the key combination that users have to press to select the function. Up to 999 different levels of access security are available for assigning to any of these menu items.

The manual comes in the original distribution archive as a text file. It contains complete information on setting up a *Spitfire* BBS, modifying the menus, and adding doors and external file protocols. It also includes instructions on setting up multiple nodes, as well as running the BBS under a DOS multitasking system, such as *DESQview* or *Windows 3.0*.

REDUNDANT MULTINODE SETUP

Unfortunately, the manual lacks a critical piece of information: an exact procedure for running *Spitfire* as a multiple-node system. Through trial and error, we found



Spitfire, Version 3.0

Buffalo Creek Software, 913 39th Street, W. Des Moines, IA 50265; Buffalo Creek BBS: 515-225-8496.

List Price: 255-user version, \$70 registration fee; with 3.5-inch disks, \$75 registration fee.

Requires: 256K RAM, hard disk, DOS 3.0 or later.

In Short: *Spitfire* is a good basic BBS but has few outstanding features. One bothersome quirk is that it requires a full system setup for each multiuser node, which uses up extra disk space on the host.

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The four-digit number next to each product is the product's **ITEM NUMBER**. Please refer to this number when ordering. Thank you.

SOFTWARE

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	☒ Adobe TypeSets for Business. ... ea. 95
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8367	☒ ATM & Plus Pack Bundle. ... 189.
7392	☒ Adobe PostScript Cartridge ... 299
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8000	☐ Persuasion 2.0 for Windows ... 339
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5104	☐ Alpha Four 1.1 ... 309.
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1214	☐ Pizazz Plus 2.0 ... 69.
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4450	☐ dBASE IV 1.1. ... 499.
Asymetrix ... NCP	
7384	☐ Toolbook 1.5 for Windows. ... 299
Atech Software ... NCP	
9436	☐ Publisher's Powerpak 1.2 for Windows. 49
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Avery ... NCP	
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1601	☒ 1st Impression First Pack ... 57.
1600	☒ Avery 1st Impression ... 229.
Berkeley Systems ... NCP	
9885	☒ After Dark 1.0 for Windows. ... 29.
Better Software ... NCP	
9786	☐ Switch-It 3.23 ... 55.
Bitstream ... NCP	
7568	☒ FaceLift 1.2 for Windows 2.x/3.0. ... 59.
8040	☒ FaceLift 1.5 for WordPerfect 5.0/5.1 ... 59.
7569	☒ Companion Value Pack 1.0. ... 125.
8883	☒ Type City Cartridge with Deli. ... 259.
	☒ Typeface Packages. ... each 89.
Borland International ... NCP	
6242	☒ Quattro Pro 3.0. ... 339.
9695	☐ Borland's C++ 2.0. ... 339.
1514	☒ Paradox 3.5 ... 529.
7356	☐ Pascal Pro (2nd Edition) ... 209.
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Broderbund ... NCP	
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1434	☒ New Print Shop. ... 39.
ButtonWare ... NCP	
6419	☒ PC-File 6.0 ... 89.
Caere ... NCP	
6004	☒ Omnipage 386 3.0. ... 469.
8933	☒ Omnipage Professional 1.0 ... 669.

NEW!

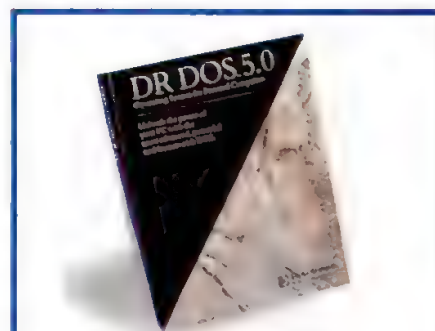
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5039	☐ PC Tools 7.0 ... 115.
8114	☒ Backup 7.0 (DOS and Windows) ... 84
9751	☐ AntiVirus 1.0. ... 84.
Checkfree Corporation ... NCP	
6360	☐ Checkfree 3.0. ... 19.
Chronologic Corporation ... NCP	
8849	☐ Instant Recall 1.2 ... 64.
CompuServe	
7546	☐ DOS Membership Kit 1.3 ... 23.
Concentric Data Systems ... NCP	
6575	☐ R & R Relational Report Writer 4.0. ... 159.
Contact Software ... NCP	
1625	☐ ACT! 2.0. ... 229.
Corel Systems ... NCP	
5506	☐ CorelDRAW! 2.0. ... 389
Data Storm ... NCP	
4798	☐ PROCMM PLUS 2.0 ... 69.
Deirina Technology ... NCP	
4325	☐ PerFORM 2.1 ... 95.
7351	☐ PerFORMPRO 1.0 ... (limited time) 159
Digital Research ... NCP	
8288	☐ DR DOS 5.0 ... 145.
9694	☐ DR DOS Upgrade to 5.0 (from any DOS version) ... 39.
DMA ... NCP	
8378	☐ PC Anywhere IV 4.03 ... 105.



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 Fast and easy to use, FaceLift scales printer fonts to any size. FaceLift for WordPerfect 1.5 now includes 16 typefaces and provides dot matrix support.
 8040 ☒ FaceLift for WordPerfect 5.0/5.1. ... \$59.
 7568 ☒ FaceLift for Windows 2.x/3.0. ... 59.

Fifth Generation Systems ... NCP	
7725	☐ Direct Access 5.1 ... 65.
3950	☐ Fastback Plus 3.0 ... 119.
FormWorx ... NCP	
9332	☐ Form Publisher for Windows w/Fill & File 109.
Fox Software ... NCP	
6188	☐ FoxPro 2.0 (exp. release 7/31/91) ... 459.
Funk Software ... NCP	
7380	☐ P.D. Queue 1.0 (print spooler). ... 59.
2228	☐ Sideways 3.3 ... 59.
Geoworks ... NCP	
8789	☐ Ensemble 1.0 ... 129.
Gibson Research ... NCP	
9832	☐ SpinRite II 2.0. ... 64.
Great American Software ... NCP	
9827	☐ Business Value Pack. ... 99.
4880	☐ One Write Plus Acct. Sys. 2.06 ... 189.
Hayes ... NCP	
7983	☐ Smartcom Exec 2.0 ... 79.
9639	☐ ILANstep 1.0. ... 349.
hDC Computer Corporation ... NCP	
7383	☐ First Apps 1.0. ... 52
Helix Software ... NCP	
9627	☐ Netroom 2.0 (single user) ... 52.
9628	☐ Headroom 2.0 ... 65.
Hilgraeve ... NCP	
8204	☐ HyperACCESS/5.2.0 (DOS) ... 65.
Individual Software ... NCP	
1328	☐ Professional Windows 1.0 (Windows 3.0) 27.
6222	☐ Resume Maker 1.3 ... 29.



Digital Research ... NCP
 9694 ☐ DR DOS Upgrade to 5.0—For any version of any DOS. Easily installs, works with all software and files. Increases 286/386 RAM availability to over 620K. ... \$39.

16, 25, 33 MHz.



Inset Systems ... NCP

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Inner Media, Inc. ... NCP

8846 ☐ Wide Angle 1.0 for Windows 69

Inset Systems ... NCP

7298 ☐ Hijaak 2.0 99.

7300 ☐ Inset Plus Hijaak 125.

Insight Development ... NCP

8320 ☐ PrinTools 1.0 85.

Intuit ... NCP

2426 ☐ Quicken 4.0 39.

1856 ☐ QuickPay 1.0 35.

LaserTools ... NCP

6882 ☐ PrintCache 2.3 99.

Lotus ... NCP

5417 ☐ 1-2-3 3.1 Plus 429.

5653 ☐ 1-2-3 2.3 349.

1852 ☐ 1-2-3 2.3 Upgrade 95.

5799 ☐ Ami Pro 2.0 309.

1847 ☐ Ami Pro Competitive Upgrade 119.

1621 ☐ Freelance Graphics for DOS 4.0 329.

MECA ... NCP

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9636 ☐ Strunk & White Elements of Style 1.0 35.

7931 ☐ Random House Encyclopedia 1.0 68.

Microsoft ... NCP

2894 ☐ QuickBasic 4.5 69.

7010 ☐ Windows 3.0 99.

7388 ☐ Project 1.0 for Windows 459.

7882 ☐ Productivity Pack 1.0 for Windows 45.

2904 ☐ Works 2.0 99.

2901 ☐ Word 5.5 209.

7387 ☐ PowerPoint 2.0 for Windows 329.

6195 ☐ Word 1.1 for Windows 329.

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8137 ☐ Office for Windows (includes Excel, PC Mail, Word for Windows, and PowerPoint) 499.

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2982 ☐ WillMaker 4.0 39.

OCR Systems ... NCP

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9878 ☐ ReadRight 3.0 for Windows 309.

Okna ... NCP

9696 ☐ Desktop Set 3.0 for Windows 85.

Passport Design ... NCP

1329 ☐ Encore 2.0 379.

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5902 ☐ PC Globe 4.0 39.

5900 ☐ PC USA 2.0 39.

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7048 ☐ Monarch 1.0 319.



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7858 ☐ Express Publisher 2.0 89.

Precision Software ... NCP

6600 ☐ Superbase 4 for Windows 1.3 429.

Qualitas ... NCP

7539 ☐ 386MAX 5.1 75.

7967 ☐ BlueMAX 5.1 for PS/2 (3 1/2" only) 85.

Quarterdeck ... NCP

6422 ☐ QRAM 1.0 54.

3221 ☐ Expanded Memory Mgr. 386 5.1 65.

3220 ☐ DESQView 2.3 85.

4586 ☐ DESQView 386 2.3 145.

QUE Software ... NCP

4155 ☐ RightWriter 4.0 54.

1857 ☐ RightWriter 4.0 Network 169.

Reality Technologies ... NCP

7891 ☐ WealthStarter 1.0 39.

6572 ☐ WealthBuilder 1.1 99.

Reference Software ... NCP

4396 ☐ Grammatik IV 2.0 59.

7483 ☐ Grammatik for Windows 2.0 59.

Revolution Software ... NCP

4480 ☐ VGA Dimmer 3.0 (screen saver) 29.

Roykore ... NCP

8182 ☐ ABC Flowchart 1.1 189.

Sitka ... NCP

6675 ☐ TOPS Network Bundle 3.0 159.

3720 ☐ Flashcard 2.1 (AppleTalk network card) 155.

7330 ☐ Flashcard MicroChannel 219.

Softlogic Solutions ... NCP

3542 ☐ Software Carousel 5.0 55.

Software Publishing ... NCP

3496 ☐ Professional Write 2.2 169.

9638 ☐ Professional Write Plus 1.0 169.

9490 ☐ Harvard Graphics 1.0 269.

3482 ☐ Harvard Graphics 3.0 (limited time) 359.

Software Toolworks ... NCP

9859 ☐ Word for Word/Windows 4.2 47.

9860 ☐ Word for Word/Professional 1.0 89.

Solution Systems ... NCP

7977 ☐ Brief 3.1 (Programmer's Editor) 189.

Spinnaker ... NCP

1415 ☐ PFS: WindowWorks 1.0 129.

7604 ☐ PLUS for Windows 2.0 289.

Stac Electronics ... NCP

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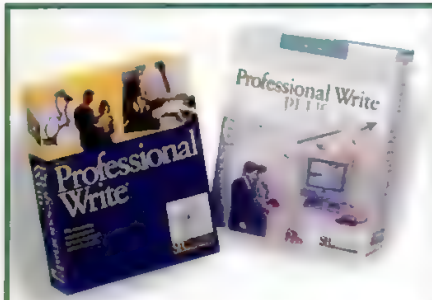
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7999	☐ Norton Anti-Virus 1.0 89.
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6564	☐ Software Bridge 5.0 79.
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7577	☐ PC-FullBak+ 2.0..... 52.
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6791	☐ WordStar Professional 6.0..... 199.
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1202	☐ XTree Easy 1.0 45.
6161	☐ XTree Gold 2.0 95.
Z-Soft ... NCP	
1626	☐ Publisher's Paintbrush for Windows ... 299

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1836	☐ Where in America's Past is Carmen Sandiego 39.
5851	☐ SmCity..... 33.
8886	☐ SmEarth..... 45.
Electronic Arts ... NCP	
4534	☐ Mavis Beacon Teaches Typing 1.0 (CP) 35.
1334	☐ Chuck Yeager Air Combat Trainer..... 42.
Harvard Associates ... NCP	
2324	☐ PC Logo 3.0..... 59.
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	☐ Word Torture for Windows ea. 34
	☐ Word Torture 3.0 ea. 29.



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7881	☐ Entertainment Pack for Windows 1.0 ... 29
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Microsoft Press (Books)	
8129	Running Windows (2nd Edition) 22
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7674	☐ Nemesis Go Master 4.7 41.
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7105	Smart UPS 600 469.
6811	Back-UPS 360 219.
7106	Back-UPS 520 329.
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9821	VGA Basic-16 (640 x 480, 16 colors) 85.
9985	VGA Integra (1024 x 768, 16 colors) 129.
9629	VGA Wonder XL (256K upgradable to 1MB) 199.
9619	Ultra/8514 Graphics Card (512K) (req. VGA) 419.
1838	Ultra/8514 & VGA (512K upgrade to 1 MB) 479.
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9620	9600etc/e Modem 379.
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7001	BOCARAM/AT PLUS (0k) 119.
7150	BOCARAM/AT PLUS (2 Meg) 219.
7139	(4 Meg) 329. 7138 (8 Meg) 539.
6998	I/O Board for AT 59.
6999	I/O Board for Microchannel (S/S/P) 109.
8380	BasicVGA (256K, 640 x 480) 69.
8381	SuperVGA (1 Meg, 1024 x 768) 145.
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7400	2 Position Laser Compatible Switch Box. 109.
Brown-Wagh ... 1 year	
	Creative Labs Sound Blaster 159.
Canon ... 1 year	
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7897	BubbleJet Ink Cartridge (BJ-10e) 23.
7896	BJ-10e Sheet Feeder 75.
9828	BubbleJet Ink Cartridge (BJ-300 & BJ-330) 26.
CH Products ... 1 year	
7801	FlightStick w/Falcon 49.
7345	Rollermouse (Trackball) serial 85. bus 99.
CoStar ... lifetime	
6091	The Organizer (mobile storage cart) 199.
1418	AddressWriter Envelope Printer 469.
1812	LabelWriter II Printer 195.
Curtis ... lifetime	
9756	Keyboard Space Saver II KS-2 39.
1708	Ruby-Plus SPF-2+ 65.
7358	Command Center SPF-4 89.
	Glass Filter Plus (specify size) each 65.
Cyrix Corporation ... 5 years	
MATH COPROCESSORS	
9875	FasMath 83D87-25 185.
9876	FasMath 83D87-33 195.
9877	FasMath 83S87-16 (SX compatible) 115.

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	Key tronic ... 3 years	
4518	101 Plus Keyboard	\$99.
	Kraft ... 5 years	
5800	3 button Thunder Joystick	29
7862	TopTrak (Laptop Trackball)	55.
	Logitech ... limited lifetime	
6029	Trackman <i>serial</i> 85. 6028 <i>bus</i>	89.
2343	Trackman Portable	105.
1484	ScanMan 32	169.
7975	ScanMan 256	319.
8694	MouseMan (<i>serial</i>) 69. 9766 (<i>cordless</i>)	139.
	Megahertz ... 5 years	
1193	T324D 2400 Modem (<i>for Toshiba Laptops</i>)	129.
1196	T224 2400 Modem (<i>for Toshiba Laptops</i>)	129.
1187	T324FM 96/24 Fax Modem (<i>Toshiba Laptops</i>)	299.
1199	T52CC - 2 Meg Upgrade for Toshiba T1000 series or T2600SX	299.
	Micron Technology ... 2 years	
7595	2 Meg Expansion for HP LaserJet IIP or III	119.
7012	Memory Upgrade PS/2 70 - 2 Meg.	139
	Microsoft ... lifetime	
7597	Microsoft Mouse (<i>bus or serial</i>)	89.
2897	Mouse with Paintbrush (<i>bus or serial</i>)	105
2898	Mouse with Windows 3.0 (<i>bus or serial</i>)	149
1956	Mouse with Works (<i>bus or serial</i>)	155.
1896	Ballpoint Mouse (<i>serial only</i>)	119.



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2361	LQ-870 (80 col., 330 cps) 489.
2357	LQ-1170 (136 col., 330 cps) 669.
5184	LX-810 (80 col., 180 cps, 9 pin) 185.
Everex ... 1 year	
1683	Tempo LX Notebook (5 Meg, 60 Meg HD) 3499.
Hauppauge Computer ... 1 year	
9031	20 MHz 386 Motherboard for PC 995.
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9870	25 MHz 386 Motherboard for AT 1099.
9034	33 MHz 386 Motherboard for AT 1339.
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7391	Ultra 9600 Modem 669.
9884	Pocket Edition 2400 Plus 129.
Hewlett-Packard ... 1 year	
9993	LaserJet IIIP (with toner) 1149.
6754	LaserJet III (with toner) 1679.
Hitachi ... 2 years	
9492	CM1483M 14" SVGA Monitor (1024 x 768) 599
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6421	2400B MNP Internal Modem 199.
5119	2400 Baud External Modem 179.
6420	2400EX MNP Modem 229.
7880	9600EX Modem 529.
2346	Inboard 386/PC with 1 Meg 495.
5336	Above Board Plus 8 2 Meg 449.
5342	Above Board Plus 8 I/O 2 Meg 479.
7782	SatsFAXtion (fax board) 399.
8778	SatsFAXtion for Microchannel 449.
8901	Matched Memory 2 Meg (PS/2) 139.
8903	Matched Memory 4 Meg (PS/2) 299.
	Matched Memory (for LaserJet IIP, III, IIIP, IIID)
1810	1 Meg 99. 1787 2 Meg 299.
1637	Snap-In 386 389.
MATH COPROCESSORS	
7385	80287XL (16 MHz 80286 CPU's) 89.
4750	80387SX (16 MHz 80386SX CPU's) 129.
2372	80387-20 (20 MHz 80386 CPU's) 219.
4121	80387-25 (25 MHz 80386 CPU's) 219.
Kensington Microware ... 1 year	
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7899	Expert Mouse serial 119. 7900 bus 129.



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7271	Inport	79.	6330 PS/2..... 79.
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5085	Multisync 3Ds Monitor		689.
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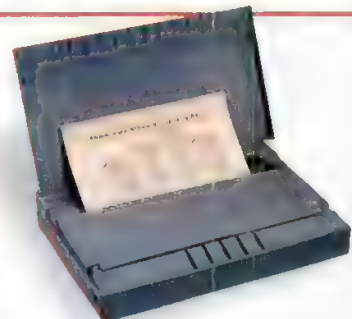
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6779	25 Cartridges in One! (for LJ II, IIP, III)	275
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7055	2 Meg 149. 7759 4 Meg	259
	Memory upgrade for LaserJet III/III:	
6838	2 Meg 249. 6836 4 Meg	379
	Pacific si Memory:	
2252	1 Meg 99. 2253 4 Meg	319
7158	Pacific Page PE 4.0 (for LJ IIP/III)	379
6834	Pacific Page (for LJ II) w/2 Meg Mem. Brd.	379
9833	Pacific Page XL (w/accelerator board)	799
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8144	KXP 1624 (192 cps, 132 col.)	399



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8993	2400 Baud Internal Modem (V.42 bis)	169
8994	2400 Baud External Modem (V.42 bis)	209.
4542	2400 Baud Internal Modem for PS/2	229
8132	PM2400 Pocket Modem	109.
7934	PM9600SA Modem	469

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1305	Universal Notebook (for ntbk. computers)	69
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8082	TheComplete Half Page Scanner/400	289.
5828	TheComplete Communicator	449

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9893	T2000SX Notebook (40 Meg)	2999.
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6199	Isobar 4-6 (4 outlets, 6 ft. cord)	49.
6200	Isobar 6-6 (6 outlets, 6 ft. cord)	59
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4931	VRAM II VGA 512k	259
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1181	2400 Baud V.42bis Modem	159



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4326	1.44 Meg Drive for AT (3 1/2")	89
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6951	1.2 Meg Drive for AT (5 1/4")	75.

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2792	3 1/2" DS/DD 720k Diskettes (Qty. 10)	13.
2793	3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10)	21.



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3298	3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10)	18.
6148	3 1/2" DS/DD (3 Pack)	29
6375	3 1/2" DS/HD (3 Pack)	49.
8185	QD 2040 Tape Cartridge	19
1895	QD 2120 Tape Cartridge	22
3M ... lifetime		
3943	DC 2000 Tape Cartridge	19
6065	DC 2080 Tape Cartridge	25
3944	DC 600 Tape Cartridge	29
5679	DC 6150 Tape Cartridge	29

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6556	256k DRAM (100 ns, set of 9)	call
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7813	256k x 4 Chips	call

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7934 PM9600SA Modem—Practical Peripherals does it again by making communications affordable with their newest modem featuring the data compression & error correction of 9600bps V.32 & V.42bis operation \$489.

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CONNECTIVITY BBS SOFTWARE



that the only way to run multiple nodes is to have a copy of *Spitfire* for each of them. *Spitfire* does have built-in multiuser capabilities, but it requires you to set up a full BBS for each node. You have to copy all the system files to each node's subdirectory on the host and start the BBS from there. Some competing multiuser BBS packages manage to avoid this approach because each node's subdirectory contains only the system files specific to it.

While configuring the BBS, you also must change one parameter in the node's configuration to reflect its number and toggle another to tell the BBS it's running in a multiuser environment. The various nodes can share the message and file areas because they reside in a central place, usually within subdirectories beneath the system directory of node 1. Since each node is a complete system, it can have different menus and security parameters.

Local log-ons are available by passing a bps rate of 0 on the command line or in an SF.BAT file to *Spitfire*. Thus you can use the software as a central message system for a LAN. But having a complete

system for each network user means that you will use more disk space than with other BBS software packages.

Spitfire comes with limited internal support for FidoNet and PCRelay networking, though you need to use external utilities to move the messages to and from the board and out onto the networks. The package does not include Zmodem as an internal file-transfer protocol, but you can add it to the system as one of 14 external protocols. The author's Buffalo Creek BBS, as well as a FidoNet echo, provide technical support for the software.

Although the basic software supports up to 255 nodes, setting up each node as a complete BBS keeps *Spitfire* from really presenting a viable choice as a messaging system on a LAN. This requirement also makes it cumbersome to install *Spitfire* as a multiuser dial-in system, but the software nevertheless provides a dependable and affordable system.

TBBS (The Bread Board System), Version 2.1

TBBS (The Bread Board System) makes sure sysops can always get into the system without hogging one of the dial-up user lines or waiting through busy signals for one to free up. *TBBS*, made by eSoft, provides native support for multiple users.

Up to 32 callers can dial in, but *TBBS* still maintains a local console that's available to the sysop at all times. *TBBS* also offers powerful security features, a programmable and highly customizable user interface, and a way for multiple users to dial in and access *dBASE* programs and data on a network. A single-user version costs \$299.95, and eSoft sells multiuser versions at \$895 for 16 users and \$1,495 for 32 users.

Installation is automatic. *TBBS* offers three default configurations: message-oriented, files-oriented, and a traditional BBS that offers a balance of message and file areas. A full-screen utility called MO-DEMSET can automatically configure a

FACT FILE

TBBS (The Bread Board System), Version 2.1
eSoft Inc., 15200 E. Girard Ave., #2550, Aurora, CO 80014; 303-699-6565, eSoft Support Software BBS: 303-699-8222
List Price: 1-user version, \$299.95; 16-user version, \$895; 32-user version, \$1,495.
Requires: 512K RAM, hard disk, DOS 3.1 or later.



In Short: A powerful native multiuser system, with strong security and a programmable, highly customizable user interface, *TBBS* offers sysops access to the local console at all times. An add-on module lets users dial into a network and access *dBASE* programs and data. But the only options for hooking into a FidoNet network are eSoft's *The NetMail Option* and *The Integrated Mail System*. Apart from that small drawback, this product is well worth its price.

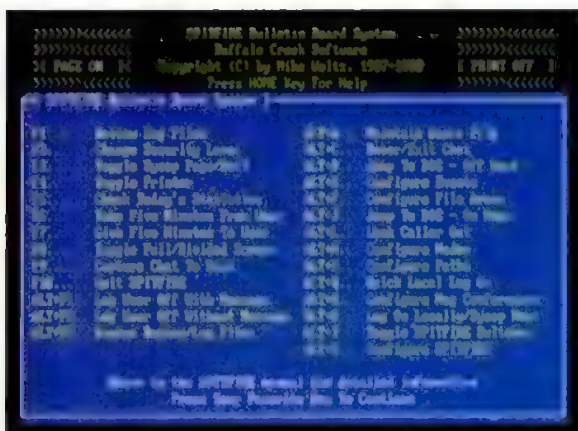
CIRCLE 423 ON READER SERVICE CARD

wide variety of modems, and the well-organized manual includes a section documenting the proper settings for many models. *TBBS* uses DigiBoards to supply multiple dial-up lines and will automatically take advantage of LIM 3.2 or 4.0 expanded memory to increase performance. The program requires at least a 20MB hard disk.

TBBS comes with several full-screen configuration utilities. CEDIT defines the system itself, including the modem ports, levels of user accounting, message boards, and user-to-user conferences. QAEDIT is a questionnaire editor that lets you set up user surveys of two types: long-response and multiple-choice.

PROGRAMMABLE INTERFACE

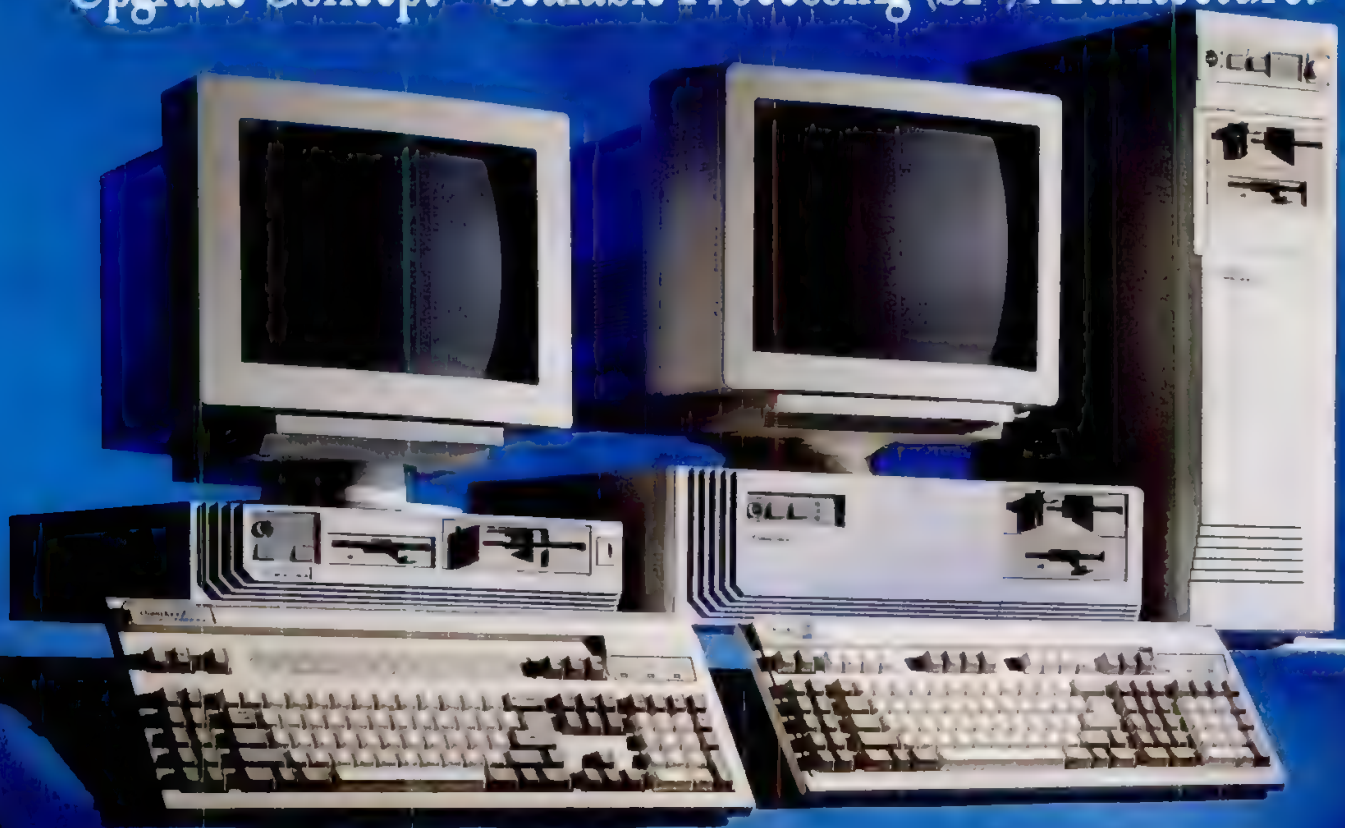
Two utilities help modify the user menus. MEDIT makes simple changes and sets various security flags for each menu choice. MEDIT has 50 different menu choices available, divided into five functional groups. *TBBS* also supplies the SDL, or System Definition Language, compiler, which you can use in place of MEDIT to customize the user interface completely. SDL contains menu functions, as well as branching logic statements. The language's built-in macro capability helps you avoid retyping program statements when you're programming repetitive menu selections. These capabilities make *TBBS* the most customizable of the native multiuser packages.



Spitfire's help screen is always available, providing you with the information you need to invoke options such as capturing a chat, taking time away from a user, and jumping to DOS.

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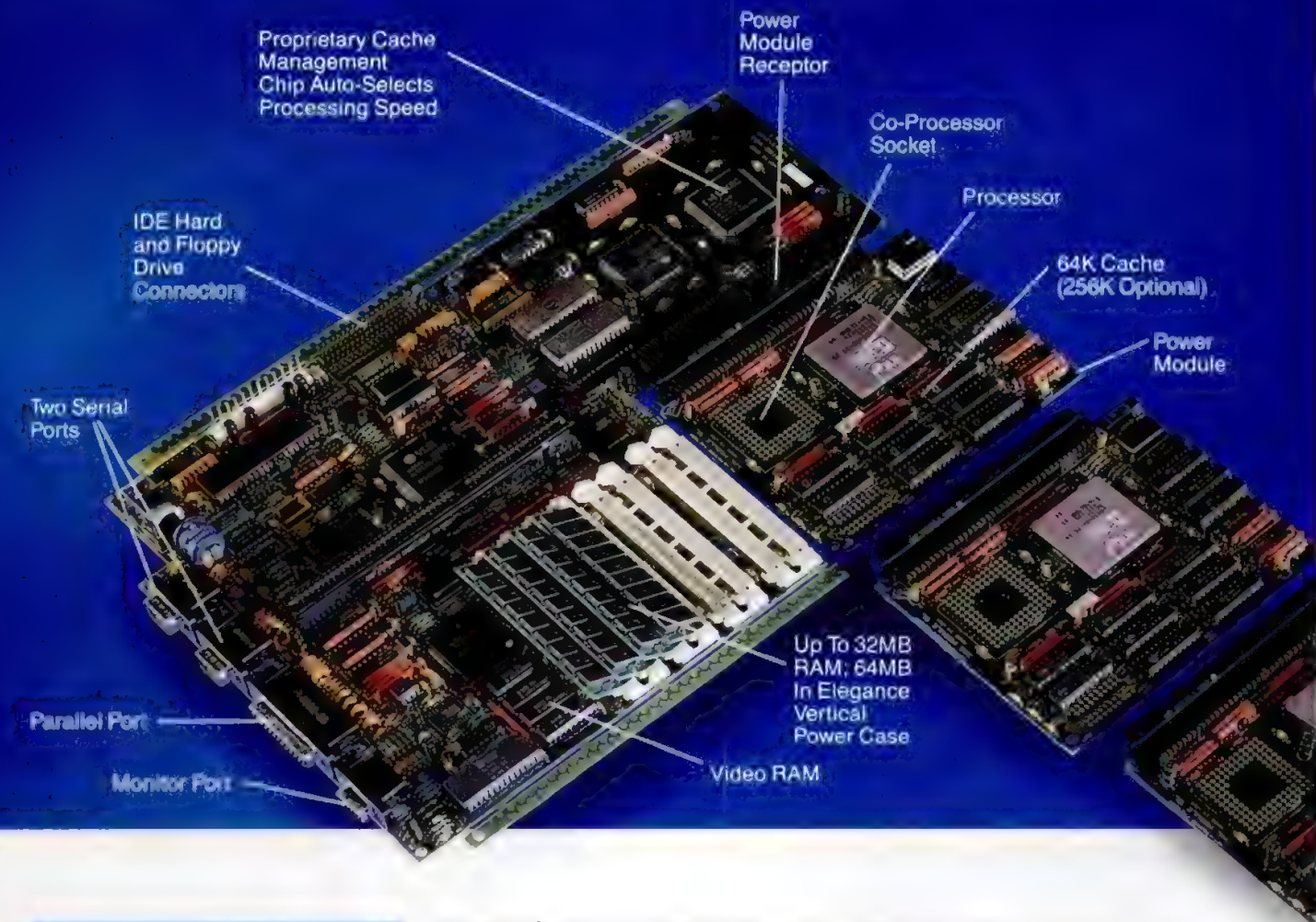


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CONNECTIVITY BBS SOFTWARE

You can add more functions to *TBBS* through extra-cost add-in modules. *SYSOM*, a \$99.95 module, allows you to edit user files remotely and drop to DOS. *TBBS* does not provide doors, however. eSoft's *The NetMail Option* and *The Integrated Mail System* (or *TIMS*) modules furnish everything needed for the BBS to hook into a FidoNet network. Unfortunately, they supply the only networking option. The sysop's choice of network support programs is limited because no third-party FidoNet networking utilities are available for *TBBS*. *The NetMail Option* sells for \$99.95. *TIMS* for a single-line BBS costs \$189, or \$259 for multiple lines. Both *TIMS* packages include the NetMail option.

REMOTE dBASE ACCESS

eSoft recently released *The Data Base System*, or *TDBS*, an add-on priced at \$395 for one user, \$995 for 16 users, and \$1,795 for 32 users. *TDBS* offers these multiple users access to *dBASE* programs and files through the BBS. While *TBBS* itself is not accessible from a LAN, it can access data (like *dBASE* information via *TDBS*) stored on a file server if you run it on a LAN-attached workstation. Using *TDBS*, dial-in users can access the same *dBASE* programs and data as users on the LAN. This capability makes *TBBS* a good choice for on-line order entry systems.

Version 2.1 of *TBBS* includes several common internal protocols like Xmodem, Ymodem, and Kermit, but it does not support Zmodem or external file-transfer protocols. An internal Zmodem is scheduled for Version 2.2, which was due for release in late summer of 1991.

Among its security features, *TBBS* offers up to 255 user access levels, along with a lock-and-key system for each menu function. A user must have both the proper access level and authorization flag to use a particular menu choice. The flags extend the effective number of access levels



TBBS, one of the most configurable BBSs available, provides message boards, user-to-user conferences, options to define levels of user accounting, and more. In action, the package provides status information for each line and includes a real-time monitor for fine-tuning system performance.

to well over 4 million possible combinations—the most of any of the three native multiuser systems tested here. If you have any questions, the company provides support via its BBS as well as 24-hour telephone support, but the call is not toll-free.

With its high degree of customization and security support, and the addition of direct support for *dBASE* applications, *TBBS* will fill the needs of many organizations for on-line customer and field representative support, as well as in many other applications.

Wildcat!, Version 2.55

Mixed in with *Wildcat!*'s many good points are some deficiencies that keep it from making its way to the top of the business BBS packages, although an upcoming release of the Mustang Software program holds promise. The current release, Version 2.55, costs \$129 for the single-user version, \$249 for a 10-user version, and \$499 for 250 users.

Installing *Wildcat!* is a simple, automated process. The program requires about 1.5MB of disk space. The installation program creates the necessary subdirectories, copies the appropriate files to

them, and runs the *MAKEWILD* configuration program. *MAKEWILD* lets you reset defaults for the message and file areas, security levels, and, if the board is going to be part of FidoNet, the node information. The spiral-bound installation manual explains all the different *Wildcat!* configuration options in great detail, making it easy to change the system to suit your needs.

HOBBYIST ROOTS

Unfortunately, *Wildcat!* shows its roots as a hobbyist system, as it only allows 24

different message areas, and 26 file areas. *TBBS*, on the other hand, offers 63 message and 63 file areas, while *RemoteAccess* and *Searchlight* both support about 200 message and 200 file areas. In addition, *Wildcat!* supplies only 50 levels of security, placing it in the bottom third of the BBS packages we reviewed for this issue. You can modify the menu structure only as far as changing the name and activation key for the various menu functions and setting the security levels needed to access them.

One interesting feature of *Wildcat!* is its ability to post a message file to a user while he or she is on-line. If you need to inform someone that you have to take down the bulletin board for some reason,



FACT FILE

**Wildcat!,
Version 2.55**
Mustang Software
Inc., P.O. Box
2264, Bakersfield,
CA 93303. 800-
999-9619, 805-
395-0223. Wildcat!
HQ BBS 805-395-
0650

List Price: 1-user version, \$129; 10-user version, \$249; 250-user version, \$499. 1-user version available on-line.

Requires: 384K RAM, hard disk, DOS 3.1 or higher.

In Short: The current version of *Wildcat!* is fast software with many shortcomings that show its hobbyist roots, including a limited number of file and message areas and security levels. But it includes most of the major file-transfer protocols and comes with a LAN monitoring utility. Look forward to the next release, which promises to address most of the program's shortcomings.

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Seagate ST1182A	143MB, 15ms, IDE, HH	559
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CONNECTIVITY

BBS SOFTWARE



you press a hotkey and send your message out. Ten different message files are supported; five of them automatically log the user off the bulletin board after displaying the file. One serves as the permanent lockout key; after the user is logged off, it denies him or her future access to the system.

Wildcat! is FidoNet-aware, offering limited built-in support for sharing messages with other FidoNet systems. But you still need third-party utilities to move the messages on and off the system and a front-end package to communicate with other nodes.

LAN MESSAGING LIMITATIONS

Although it can run as a multiuser system through a LAN, *Wildcat!* does not have a way to log local users into the BBS automatically via a batch file. They have to log in through the main system screen, which



The main screen of *Wildcat!* provides constant monitoring of system resources, including the number of users, files, messages, and total calls. The program also lets sysops post messages to users while they are on-line; for example, a touch of a hotkey can inform someone that you have to take down the board.

limits *Wildcat!*'s usefulness as an in-house messaging or mail system. One nice LAN feature, however, is the CATEYE utility, a small TSR you can run on a LAN workstation to monitor activity on the various BBS nodes.

Mustang built most of the major file-transfer protocols into *Wildcat!*, including Zmodem. Up to ten external protocols are supported as well. Additionally, like its namesake, *Wildcat!* runs fast, with particularly quick screen updating and message processing.

TECHNICAL SUPPORT

Also on the plus side are Mustang's technical support policies. The company provides free phone support from 8:30 to 5:00 P.S.T. for 90 days after purchase. Lifetime support is available on a private BBS, and through CompuServe's PC Vendor A (PCVENA) forum. A CompuServe introductory pack comes with every package. \$50 a year buys an extended support plan that lengthens the phone support period by one year and ensures that you receive a copy of every minor update and reduced prices on major upgrades.

In fairness to Mustang, many of the limitations we've discussed here will be removed in *Wildcat!*, Version 3.0, which was in alpha testing at press time. The new version is due for release in late summer of 1991. Of particular interest will be the increase in the number of message and file areas to 1,000 each, the doubling of the number of security levels, and the ability to log onto the BBS directly and use the software as a LAN-based message and conference system.

In its current form, *Wildcat!* is better suited for dial-in use only. Mustang's software does not include a configuration option or a command that tells it to go into local log-on mode automatically when it's first executed. You might be able to

rig up the proper initialization sequence with a keyboard-stuffing utility like *PC Magazine's* KEYFAKE or the shareware program *StackKey*, but other BBS programs already have this capability built-in. Nevertheless, the current *Wildcat!*'s speed and network support will make Version 3.0 worth some consideration when it's released.

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POSTSCRIPT

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**TEXAS
INSTRUMENTS**



ILLUSTRATION: DON BAKER

E-MAIL LAN LINKS

E-mail, the lifeblood of many businesses, enables users to get memos and messages into the hands of coworkers quickly and conveniently.

When your organization expands, you want your e-mail system to grow with it. The gateway options of these five programs make that happen.

Gateways to the World

BY M. DAVID STONE LAN-based e-mail systems are a lot like a well-run citywide subway system: a great way to move around locally, but limited in scope. When you want to send messages further than a LAN-wide package can take them, you have to switch the way you handle your mail.

Just as a subway can take you to an airport, bus station, or train station, e-mail packages—or other programs with e-mail capabilities—provide ways for you to tie into a wider e-mail network. The feature that

does this is called a gateway, a well-chosen name, since it turns your e-mail system into a gateway to the world. In this review, we will look at the proprietary and MHS e-mail gateways offered for *cc:Mail*, *Lotus Notes*, *Microsoft Mail for PC Networks*, *Office Works*, and *WordPerfect Connections*. Of these five packages, three—*Lotus Notes*, *Office Works*, and *WordPerfect Connections*—are workgroup software programs that provide options in addition to e-mail, such as resource scheduling, calendars, or a DOS shell.

Unfortunately, programs define the term *gateway* differently, leaving lots of room for confusion. For our purposes, a gateway for a LAN-based e-mail system is a built-in or optional function provided by the vendor that lets the system ex-

change messages beyond the LAN, beyond the e-mail program, or both. While the Message Handling Service (MHS) utility available from Novell as *Novell MHS* is often described as an MHS gateway, for the purposes of this review we will refer to it simply as MHS, while defining an MHS gateway as that function that moves messages between the e-mail package and MHS. (For a closer look at MHS, see the sidebar, "MHS: The Glue That Binds Network E-mail.")

KINDS OF GATEWAYS

Gateways fall broadly into two categories: *asynchronous proprietary gateways* on one hand and, for lack of a better term,

foreign-format gateways on the other.

Asynchronous proprietary gateways, often called *async gateways* or *proprietary gateways*, allow an e-mail system to exchange messages with another LAN installation running the same e-mail program. Their function is to span the gap between physically distinct LANs, usually by way of a modem connected through standard phone lines, or sometimes over a serial cable that connects two LANs. Such gateways can link over almost any transport medium, including leased lines, ISDN, and more exotic choices. (For a look at the range of transport media options, see "Linking LANs: The Media Move the Message" in this issue.)

When most people think of e-mail gateways, they are really thinking of for-

GLOSSARY: E-mail Gateways

by M. David Stone

■ **automatic directory propagation**
The ability to update user addresses automatically in one domain after manually entering address changes in another domain, whether on the same LAN or on another LAN connected by a gateway. In general, automatic directory propagation can be *peer-to-peer*, where changes in any post office are sent to all other post offices, or *master-to-slave*, where changes in the master post office are sent to the slaves, but changes in the slave post offices do not go to the master. (See *master/slave link*.)

■ **domain**
A term defined differently by various e-mail vendors. Here, a domain refers to a set of hosts on a single LAN that needs only one intermediary post office to move mail from one host to another. A domain may consist of only one host, depending on its design and implementation.

■ **gateway**
The module or function within an e-mail system that lets the system communicate to the outside world. For example, an asynchronous proprietary gateway adds asynchronous communications features so that an e-mail system can exchange mail with LANs that use

the same e-mail system, by modem or by direct-connect cable. Similarly, an MHS gateway will let the e-mail system send mail to diverse e-mail systems through *Novell MHS*, an MCI gateway will let the system send mail through MCI, and so forth. Other gateways let the e-mail system exchange mail with any other e-mail program that has a gateway to the intermediary system.

■ **host**
The smallest post office of an e-mail system. Mail sent to users within a given host is available to the addressee immediately.

■ **master/slave link**
A type of communications link where one side initiates all calls.

■ **master-to-slave directory propagation**
A way of updating user addresses where changes in the master post office are sent to the slaves, but changes in the slave post offices are not sent to the master.

■ **Message Handling Service (MHS)**
A utility for *NetWare* LANs that provides a common format for exchanging information among applications. MHS is most commonly used for e-mail.

Various e-mail programs use the MHS format for exchanging e-mail messages.

MHS is often called an MHS gateway. But for our purposes, MHS refers to the standard utility, available from Novell as *Novell MHS*, while the term *MHS gateway* refers to the function in an e-mail program that translates between the e-mail program and Novell's MHS. (See *gateway*.)

■ **multiple domains**
A set of domains on a single LAN, each of which has its own domain-wide post office. Hosts within each domain can exchange mail by going through one domain post office. Hosts in different domains must generally send mail through two intermediary post offices: the sender's domain post office and the receiver's domain post office. (See *post office*.)

■ **peer-to-peer directory propagation**
A way of updating user addresses in which changes in any post office are sent to all other post offices.

■ **peer-to-peer link**
In terms of e-mail gateways, a type of communications link where a gateway can both initiate a connection and wait for an incoming call.

eign-format gateways. The basic job of this type of gateway is to convert messages between formats, letting the e-mail program exchange messages with other kinds of e-mail systems either directly (for example, between *cc:Mail* and MCI), or through intermediate standard formats such as MHS.

These gateways are usually named for the foreign format with which they can exchange messages. For example, a module that lets a given e-mail system exchange messages with other systems using MHS is that system's MHS gateway. Similarly, a module that lets the system exchange messages with MCI Mail is that system's MCI gateway.

One special subset of foreign-format gateways is message exchange with modes

of communication other than e-mail. The most common such gateway today is for fax messages. A fax gateway converts your e-mail message to fax format and typically sends it with a fax board. The gateway may also let you receive faxes, store the incoming messages in .PCX or another graphics format, and view the image on screen or print it out, much like a fax package for a standalone system.

Any given e-mail system can, in principle, have a separate gateway for every other e-mail system. And indeed, in addition to the choices already mentioned, you can find e-mail packages with gateways to public access networks such as EZLink and SprintMail, to mainframe systems such as IBM's Professional Office System (PROFS), and more.

The sheer number of established e-mail packages, not to mention the additional choices coming to market, has created a Tower of Babel. Trying to maintain interoperability by using a separate gateway for each kind of system is a clumsy solution. When you have to connect unlike systems, a better choice is to use an intermediate standard format that allows one gateway to connect your e-mail system to any number of other systems.

The benefits of a standard format are so clear that the industry has produced several. In the long run, the best bet for users who need to connect many disparate systems, particularly those with international concerns, is X.400. This is a CCITT standard designed to enable a fully interconnected global e-mail system, in the same sense that we now have a fully interconnected global telephone system. But the multiple elements of the addressing scheme of X.400 can make it difficult to use without products that also support the emerging X.500 directory system standard (see the sidebar "X.400 and X.500: In Pursuit of the Universal Mailbox").

MHS VS. PROPRIETARY GATEWAYS

While users of micro-based networks were traditionally interested in connecting to mainframe-based e-mail systems such as Digital's All-In-1 Mail Server, as micro-based networks proliferated, connecting one micro-based e-mail system to another became a concern. MHS was developed in answer to that need. Now that connection concerns are becoming more diverse, X.400 is making headway fast, but it is expensive to administer because it is

complex to implement. Though X.400 is probably the future of e-mail, today MHS remains a popular choice for users connecting PC-based networks that run various e-mail programs.

Each vendor in this review can provide users with its own MHS gateway module as easily as each can provide its own proprietary gateways between like LAN e-mail systems. While MHS and MHS gateways are limited to use on *NetWare*, Novell's large market share in the United States makes this limitation less inconvenient in this country than in countries where Novell may not have the same market share. But you can certainly see how X.400, which is not limited to any specific operating system, has an advantage, particularly when it comes to international communications.

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As micro-based LANs

proliferated, MHS

was developed to connect

unlike e-mail systems.

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With MHS running on your LAN, usually on a dedicated workstation, you can operate more than one e-mail package on the network and use MHS to move mail among them by way of MHS gateways. You can also call other LANs running MHS to exchange messages.

Unfortunately, the benefits of using an MHS gateway are undermined by some disadvantages. The limitations in MHS gateways result from limitations in MHS itself. Most e-mail programs provide features not available in MHS; while the e-mail programs on either end of a link may support a certain feature, without MHS support, the feature will not get through the MHS pipeline intact.

For example, while the limit of 1 attachment per message has been upped to a generous 64 in the latest release of *Novell MHS*, many e-mail programs can support an unlimited number of messages. Additionally, most e-mail packages know how to handle names of any length whether messages are travelling across the LAN or to a like e-mail package via a proprietary gateway; the system administrator must be sure to limit any user connected via the

■ post office

Any part of an e-mail system that directs or delivers mail. But to refer to a particular level of mail handling, the term *post office* needs a modifier. A local post office, or *host post office*, is the module that users directly interact with to send and receive mail. A *domain post office* is the module that controls the mail delivery within a domain of multiple hosts on a single network.

■ receive-only link

A type of communications link in which a gateway can answer an incoming call but cannot initiate a call. The gateway in this case can be thought of as the *slave side* of a master/slave link.

■ send-only link

A type of communications link in which a gateway can initiate a connection but cannot answer an incoming call. The gateway in this case can be thought of as the *master side* of a master/slave link.

MHS gateway to an identifier of eight ASCII characters. Yet when sending messages through an MHS gateway, programs must reduce themselves to the highest common denominator of the MHS features.

Losing a few features when going through MHS is an acceptable cost for linking diverse e-mail packages. But it's not acceptable when you have the same e-mail package on both sides of the link. If you have company-wide standardization on a single package and do not need to communicate via e-mail with outside clients or others who may use different

MHS: The Glue That Binds Network E-mail

by Rick Ayre

Novell's MHS (Message Handling Service) is sometimes referred to as the glue that binds. Indeed, this common denominator makes passing messages from one e-mail package to another through vendors' MHS gateways almost as easy as passing them between like applications through

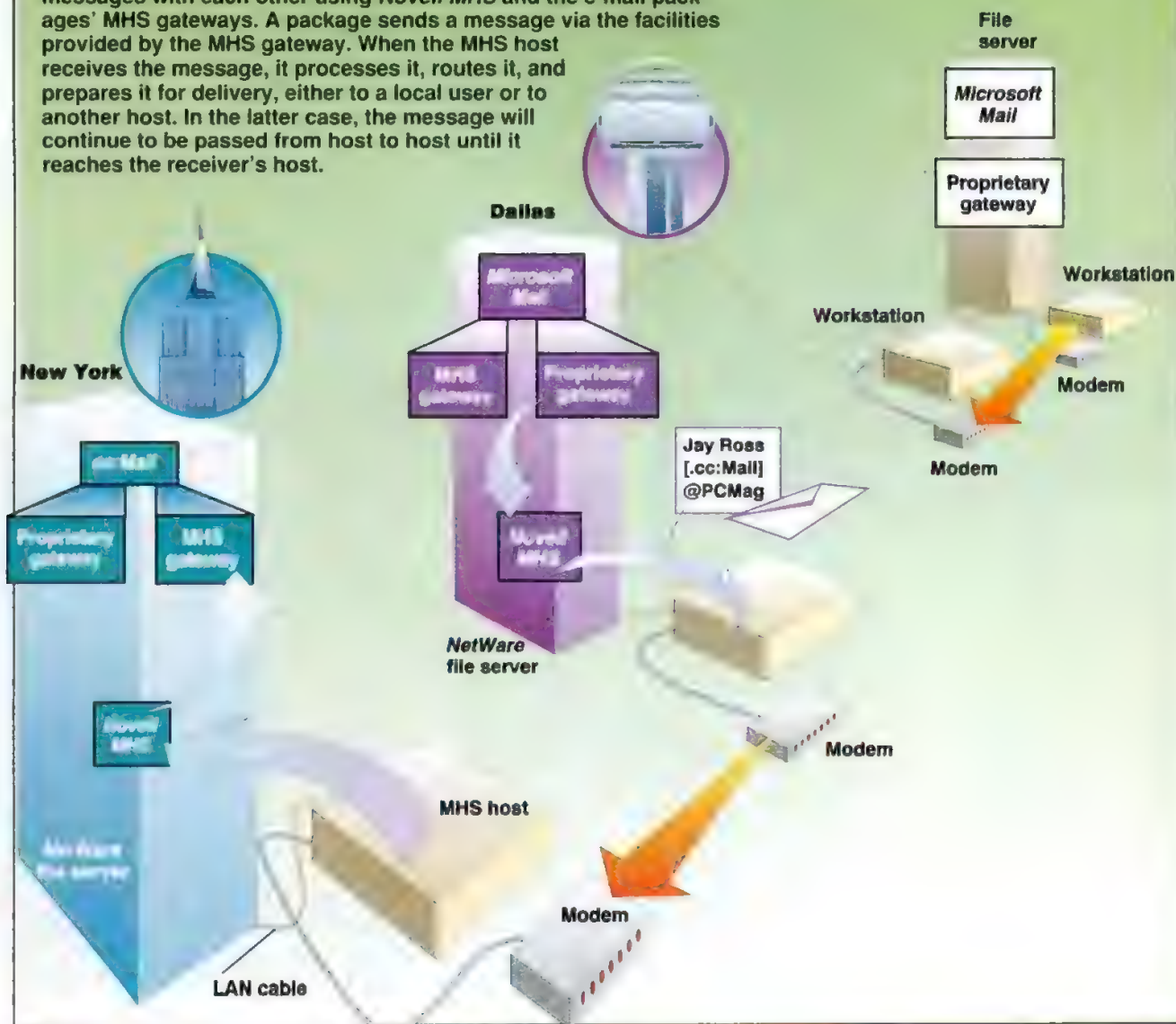
proprietary gateways.

Novell recently bought the MHS engine from Action Technologies; in the current release, Version 1.5, the product contains significant improvements over previous MHS releases. Most notably, it removes the 1-attachment-per-message limit by supporting up to 64 attachments per message.



ELEMENTS OF AN MHS LINK

The diagram shows how diverse e-mail packages can exchange messages with each other using *Novell MHS* and the e-mail packages' MHS gateways. A package sends a message via the facilities provided by the MHS gateway. When the MHS host receives the message, it processes it, routes it, and prepares it for delivery, either to a local user or to another host. In the latter case, the message will continue to be passed from host to host until it reaches the receiver's host.



Novell MHS, Version 1.5, also offers limited backward compatibility: It can interpret messages created under versions as early as 1.1. Novell's version is \$495 for the Network Edition, \$495 for the Developer's Kit, and \$100 for a standalone version. Action Technologies sells an \$89 personal version of MHS for use on a standalone PC.

PARTNERS IN MAIL

Novell does not provide a front end with *Novell MHS* for network users, as LAN e-mail and workgroup software vendors do for their proprietary and MHS gateways. *Novell MHS* is an application programming interface, or API, that includes administrative tools for the network manager. With *Novell MHS*, users can send messages across networks via any LAN e-mail program or other application, as long as it provides the required gateways to MHS (whether built-in or optional). *Novell MHS* can be viewed as a communications engine that allows distributed applications to interact. Any type of application, from databases to spreadsheets, can employ MHS facilities, although MHS is most widely used in LAN e-mail applications.

Although a vendor's MHS gateway requires *Novell MHS*, such gateways resemble proprietary gateways in other respects. Both use store-and-forward technology to queue messages and forward those that they cannot deliver locally. Both reside on file servers and are accessed via workstations. You can program both to wait for incoming calls or to call external post offices.

MHS'S THREE PROGRAMS

Novell MHS runs on what the company calls an MHS host, a workstation on the network usually dedicated to the task. The MHS host receives, processes, routes, and prepares messages for delivery. The system delivers the messages to local users or moves them from one host to another until they are on the receiver's host.

Three programs run on the host and handle all message activity. The Connectivity Manager functionally corresponds to the X.400 recommendation for a message-transfer agent (see the

sidebar "X.400 and X.500: In Pursuit of the Universal Mailbox"). It watches the message queues and dispatches messages as required, much like the way a post-office parcel sorter works. The Directory Manager is a program that lets the administrator manage the routing of messages and ensure that messages go to the appropriate host. The Transport Server sends the messages to another host, typically asynchronously via modem or between hosts on the same network.

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MHS enforces a Standard Message Format (SMF). The SMF consists of a header, an optional ASCII message, and optional attachments. The header can be thought of as a small database with fields of variable length. A few, the To, From, Subject, and Signature fields, are mandatory. Others, such as Date or In-reply-to, are optional.

A standard MHS address form is:

user{.application}@workgroup

Each field in the address—user, application, and workgroup—is limited to eight characters from a subset of ASCII (a–z, A–Z, 0–9, \$, #). The .application field is optional. It indicates which application (usually an e-mail or workgroup software program) should receive the message. In cases where the address does not specify, the default application gets the message. You specify this default application, or *preferred application*, when installing MHS and MHS gateways.

An extended MHS address may appear as

user[.application]@workgroup.
enterprise{foreign-address}

Again, the .application field is optional. The foreign-address field is not always optional, since you need to add it whenever you send a message through MHS to a network located in a foreign country.

Each MHS host contains routing information, but this is limited to the name of the next host to receive the message. This next-hop method of routing continues until the message reaches a host that has local delivery information about the addressee. Although MHS depends primarily on serial communication links as the method of point-to-point connection, this modular method allows the host to make far fewer calls, since neither the user nor the host needs to know the complete route the mail has to take.

Novell MHS offers little security; applications such as e-mail software must provide it. MHS does allow password protection of its administrative program, however, and ensures that once a message is deposited in a user's mailbox, only the addressee can read its contents. But *Novell MHS* includes no encrypting capability, on the wire or otherwise.

X.400 will present some competition to *Novell MHS*. While installing *Novell MHS* and MHS gateway modules will effectively connect users running diverse software packages, it will connect only those users on *NetWare* networks. And although Novell has the majority of the network operating-system market share in the United States, it does not have the whole market. It faces competition in other countries, too. X.400 has the advantage of offering support for users on any network. Novell understands the broad appeal of X.400 and X.500, and has promised to deliver X.500 directory services for MHS sometime in the future. ■

Novell MHS, Version 1.5

Novell Inc., 122 E. 1700 St., Provo, UT 84606; 800-453-1267, 801-379-5900.

List Price: Network Edition, \$495; Developer's Kit, \$495; standalone version, \$100. **Requires:** 300K RAM, *NetWare*, DOS 3.1 or later.

CIRCLE 610 ON READER SERVICE CARD

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a popular E-mail program,
maybe we should call it Post Office.



When WordPerfect Corporation created WordPerfect Office,[™] we set out to simplify the way people organize their days, schedule their meetings and communicate with their colleagues. In short, to streamline many of the most common day-to-day tasks in any office environment. And that's exactly what WordPerfect Office can do.

But meanwhile, it's also become the fastest-growing E-mail package for PCs.

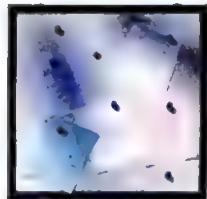
And that seems only natural. Because WordPerfect Office lets you quickly and easily send documents,



memos and schedules to the "in-boxes" of everyone on your mailing list—across the hall, across the street, wherever they're connected to WordPerfect Office.

Plus, WordPerfect Office has gateways that allow you to communicate with many other kinds of E-mail systems—MCI, AT&T Easylink and MHS, for instance.

And unlike most E-mail packages, WordPerfect Office organizes your messages in "in-boxes" and "out-boxes" and lets you check their status anytime. If you've sent a message that has not yet been read, for example, you can retrieve it and make changes. You can even delete the message completely, as though it had never been sent.





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1555 North Technology Way, Orem, Utah 84057
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systems, choosing a proprietary gateway makes sense.

In contrast to an MHS gateway, a typical proprietary gateway supports all the functions that the e-mail package allows on a single LAN. What's more, using a proprietary gateway means less work for you, if you're the administrator. Because a proprietary gateway module typically follows the same design logic and shares the same look and feel as the base package, setting up and successfully maintaining the gateway quickly become easy, logical extensions to working with the rest of the e-mail package. With MHS, you not only have to add MHS itself as another layer beyond the MHS gateway, you have to learn *Novell MHS*.

REVIEW CRITERIA

For this review of network and workgroup applications with e-mail gateway capabilities, we selected only those e-mail packages available from vendors that offer

X.400 AND X.500: In Pursuit of the Universal Mailbox

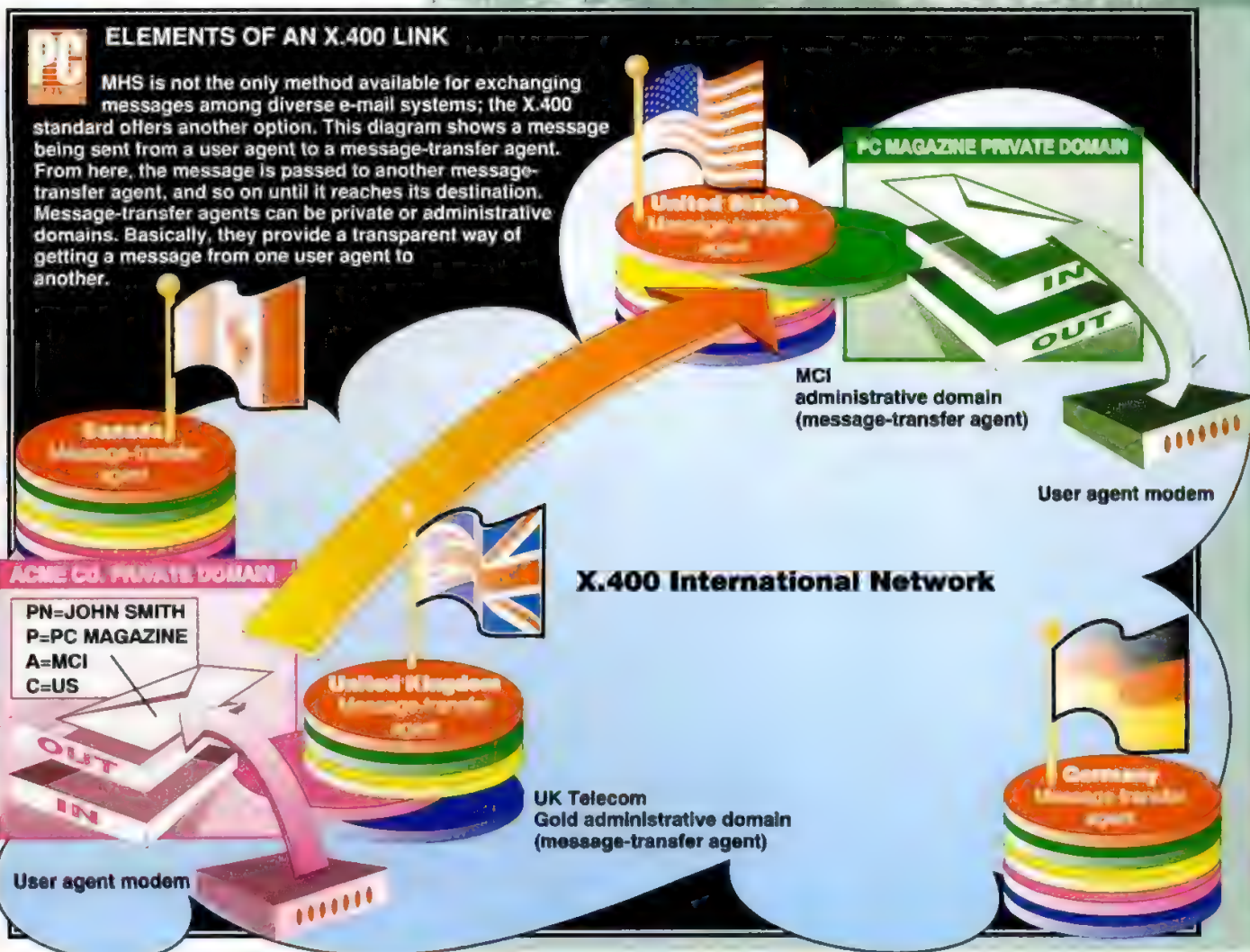
by Rick Ayre

The X.400 and X.500 recommendations of the International Telegraph and Telephone Consultative Committee (CCITT) brim with potential for connecting e-mail systems worldwide. The X.400 standard promises a truly global store-and-forward e-mail system that specifies everything from the type of data a message can carry to rules for converting between message types such as text and fax. While X.400 allows you to send e-mail to any computer user in the world, X.500 will find the address of that person. By providing specifications for directory services, X.500 defines a global directory standard for locating users by e-mail. Approximately every four years, the

CCITT updates the standards that make up the X.400 recommendations. But as with most standards-by-committee operations, implementation of those recommendations lags a few years behind. Most currently available X.400 products are based on the 1984 update. The 1988 update is just now available as an API; it was released on March 11 by Retix. The one major change in the new version is support for compound documents that contain both text and graphics. Meanwhile, APIs for the X.500 standard are now starting to arrive on the scene.

X.400 GLOBAL ADDRESSING

In simple terms, the X.400 message-handling system can be broken down



into two parts: the *user agent* and the *message-transfer agent*. The user agent is the part of the e-mail system that the user sees. The message-transfer agent takes a message from the user agent, or another transfer agent, and sends it on its way. Typically, a series of transfer agents work together to deliver a message to its destination. Transfer agents basically provide a transparent way of getting a message from one user agent to another.

The X.400 address scheme is directly tied to the model of the Message Handling System (MHS)—not to be confused with Novell's Message Handling Service. A logical group of message-transfer agents is called a *domain*. According to the X.400 rules, there are two types of logical domains. At the top level sits an administrative domain: a domain run by a government (typically the case in Europe) or an ITT (International Telephone and Telegraph) Union-certified group. In the U.S., carriers such as MCI are typical of administrative domains. A private group, such as a university or a private company, manages another type of domain at a lower level. All these domains are connected in theory; they must be connected in order for X.400 to work. A hypothetical X.400 address might look like this:

PN=JOHN.SMITH
P=PCMAGAZINE
A=MCI
C=US

Translating this address is not too difficult. The personal name is JOHN .SMITH, a unique identifier within the private domain PCMAGAZINE. The mail (administrative) carrier is MCI and the country the United States. This scheme does not seem terribly complicated, but administering it is by no means a picnic. The address could get longer with more layers, either within the private domain or between administrative ones.

X.400 gateways are available for the products we review here from the e-mail vendors themselves, third par-

ties such as Retix and Touch Communications, or services such as Soft-Switch. But it requires considerable conversion to make any of the address schemes used by the e-mail gateways we reviewed compatible with the X.400 scheme, as the address variables they now use and those that X.400 uses have no one-to-one relationship. For example, a network using *Microsoft*

.....
The name of the e-mail
address is
The name of the e-mail
address is
.....

Mail and Microsoft's X.400 gateway (set for release in July 1991), would have to group local post offices into domains and use a database to keep track of how to deliver mail when it arrives for a local user.

Additionally, with X.400, finding someone else's address is...well, it's easier to call by phone. Basically, you must know the address to send the message, which is where X.500 comes to the rescue.

X.500: A WORLDWIDE USER DIRECTORY

Because the X.500 directory is a descriptive naming service, it will allow you to search for an X.400 address. X.500 APIs are just now becoming available: no one but Retix supports them yet. The directory will eventually consist of many distributed knowledge bases, each with its own store of information about e-mail users. The directory will contain the users' addresses and other descriptive information that may help locate addresses. With the X.500 directory, you will be able to search for someone's X.400 address, even if you know only a few of the address's attributes. For instance, you could search for JOHN.SMITH at

PCMAGAZINE and turn up the complete X.400 address shown before.

The X.500 system is based on still more agents: a *directory system agent* and a *directory user agent*. Each directory system agent works as a module that keeps track of part of the directory information, usually for the domain it's in. A directory user agent sends a query to a directory system agent, which responds with the requested information. If the directory system agent does not know the answer, it gives the user a referral or hands the query off to another agent.

THE FUTURE

The ultimate goal of a global X.400 communications infrastructure is already within reach. In addition to the X.400 products and services mentioned above, some public e-mail services, MCI Mail and SprintMail among them, now offer X.400 gateways to link users internationally.

Two conditions must be met before X.400 can realize its full potential. First, organizational e-mail systems must implement the X.500 standard, or else we will use obsolete mainframes as address repositories for the complicated naming schemes that plague our personal e-mail address books. Second, a critical mass must develop: Enough people must be reachable through the X.400 gateways for it to become a truly compelling connection.

Is X.400 a cost-effective solution for you? The cost-effectiveness of all gateways depends on two factors: complexity and number of users. If your network is small and all the active users use the same e-mail package, then a proprietary gateway is a good choice. As the complexity of your PC-based network grows and you add users, an industry-standard gateway (such as an MHS gateway) becomes cost effective. When your system reaches an international scale or connects many disparate systems, X.400 will be a most effective choice. You will then be ready for connectivity with e-mail users around the globe. ■

CONNECTIVITY

E-MAIL LAN LINKS

E-MAIL GATEWAYS: SUMMARY OF FEATURES

Products listed in ascending price order

This features table applies only to proprietary gateways; the functions of the products' MHS gateways are generally limited by MHS. Some of the gateway administration features in this table are included with the basic e-mail or workgroup software package.

	cc:Mail Gateway	Lotus Notes	Microsoft Mail for PC Networks	Office Works Communications Option	WordPerfect Connections
List price	\$1,295 per use	\$62,500 (up to 200 users)	\$695 plus workstation software	\$695 (unlimited users)	\$495 per domain
GATEWAY REQUIREMENTS					
Minimal processor	80286	80386	8086	8088	8088 (80286 recommended)
RAM	110K	9MB	640K	640K	640K
Dedicated PC	Required	Recommended	Required	Required	Required
GENERAL FEATURES					
Automatic directory propagation	Optional (\$995 per host)	■	■	□	□
Administrator can customize connection scripts	■	■	■	□	□
Administrator can send messages:					
By age	□	□	□	■	□
By date	□	□	■	□	■
By day	■	■	□	□	□
By number in queue	■	■	□	□	■
By priority	■	■	■	■	□
By size	■	□	□	■	□
By time	■	■	■	■	■
Administrator notified of nondelivery of messages	■	■	■	■	■
Security:					
Passwords	■	■	■	■	□
Message encryption	■	■	■	□	■
SYSTEM ADMINISTRATION					
Remote administration	■	■	■	□	□
LAN workstation	■	■	■	N/A	N/A
Dial-in connection	Optional (\$295)	■	■	N/A	N/A
Report statistics:					
Messages sent/received	■/■	■/■	■/■	■/■	■/■
Message times/dates	■/■	■/□	■/■	■/■	■/■
Total incoming messages	□	■	■	■	□
Total outgoing messages	□	■	■	■	□
Gateway shutdowns	□	□	■	□	■
Calls made/received	■/■	■/■	■/■	■/■	□/■
Numbers called	■	□	■	■	■

■—Yes

□—No

N/A—Not applicable: The product does not have this feature.

both proprietary and MHS gateways.

We found five vendors whose packages met the requirements. The *cc:Mail Gateway* package includes both a proprietary and an MHS gateway; the proprietary gateway is included in *Lotus Notes*, but the MHS function is a \$2,500 option. Microsoft's e-mail program, *Microsoft Mail for PC Networks*, includes its proprietary gateway; its MHS gateway is a \$995 option.

Office Works Communications Option supplies the proprietary gateway for the *Office Works* package, while the MHS interface that runs in conjunction with it is an additional \$695. Likewise, *WordPer-*

fect Connections provides the proprietary gateway for the company's *WordPerfect Office*, while its MHS Gateway is available for an additional \$495 per installation.

In *PC Magazine's* most recent look at LAN e-mail packages (see "LAN E-mail Software," November 27, 1990), we reviewed 21 e-mail programs that provided MHS e-mail gateways. Missing here from the list of packages reviewed are two of the Editors' Choices from that story: *Da Vinci eMail* and *Higgins*.

We did not include *Da Vinci eMail* in this overview because it does not have a proprietary gateway. *Higgins* offers both

kinds of gateways, but the gateway module was in the midst of an upgrade during our testing. Enable Software, the company responsible for *Higgins*, was unable to provide a complete working package in time for our review.

As a separate topic within this survey, we also briefly look at several programs that are part of the evolution of e-mail towards a client/server architecture: Beyond's *BeyondMail* and *@Mail*, Reach Software Corp.'s *MailMAN*, and Software Publishing Corp.'s *Professional Write Plus* (see the sidebar "Evolving E-Mail: Will Client/Server Get the Message?").

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WeCycle Waste Corporation The Materials Research Group Recommendation: FOCUS: ALUMINUM

... Research Group provides the
... continue to

This study
basis for
expand
next 6
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during



WeCycle Waste Corporation

The Materials Research Group Recommendation:

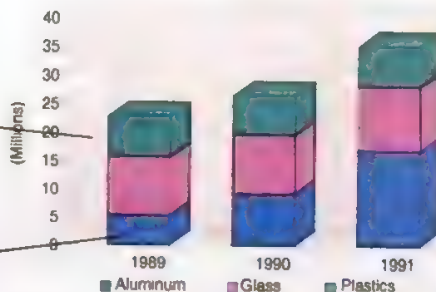
FOCUS

Aluminum

This study conducted by the Materials Research Group provides the basis for our most recent recommendation that WeCycle continue to expand its aluminum recycling capacity by another 70% over the next 6 years. The graph to the right shows the increasing proportion of our business provided by the aluminum division during the past three years, now approximately half of all revenues. It is our opinion that, at this rate of growth, aluminum recycling will continue to offer our company its greatest opportunity for expansion over the next decade, and certainly into the 21st century.



Gross Revenues by Product



Glass and Plastics

As can be inferred from the graph to the left, glass and plastics recycling has been holding steady throughout this same period, and has consequently become a smaller proportion of our overall sources of revenue.

Although this group would strongly recommend that WeCycle Waste Corporation do all that is necessary to increase its activities in these areas, our studies have shown that aluminum will become increasingly the material of choice in the shipping, heavy manufacturing and container industries.

Aluminum

It is our opinion that sources of aluminum products will be pressed close to their limits over the next decade.

Therefore, we propose that WeCycle Waste Corporation invest in more aluminum capacity during the next five years in order to take the best advantage of this increasing market demand.

WECYCLE PRODUCT	1989	1990	1991
Aluminum			
East	2,323,426	4,019,527	7,315,539
Central	1,372,347	2,374,160	4,320,972
West	1,726,492	2,986,831	5,436,033
Total	5,422,265	9,380,518	17,072,544
Glass			
East	2,496,721	2,567,821	2,798,925
Central	3,598,757	3,217,693	3,507,285
West	4,217,635	4,471,294	4,873,710
Total	10,313,113	10,256,808	11,179,920
Plastics			
East	2,897,493	3,171,243	3,234,668
Central	1,873,938	1,823,697	1,860,171
West	2,378,942	1,967,421	2,006,769
Total	7,150,373	6,962,361	7,101,608

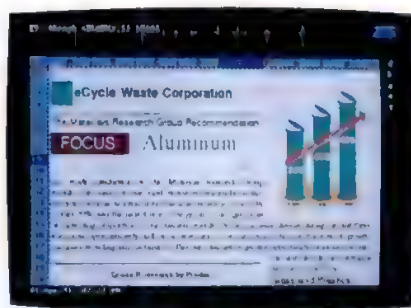
de your spreadsheet ng your hardware.

There's a lot to like about the new Lotus® 1-2-3® for DOS Release 2.3.

For starters, it's not just a graphical spreadsheet. It's a fast, graphical spreadsheet for DOS. It's easy to use. And it works as well on an older XT with just 512K of memory as it does on the newest 486 machine.

It also shares many features in common with our powerful 3D spreadsheet 1-2-3, Release 3.1. Including its superb spreadsheet formatting and publishing capabilities and full mouse support. Along with its popular Auto Compress feature that gives you a trouble-free way of making larger worksheets print on a single page.

We've also added new features you won't find in other spreadsheets. Like



With its WYSIWYG graphical environment, you can do all your formatting "live" on screen.

the Viewer (based on Lotus Magellan® technology) which lets you view files before retrieving them and makes file linking as easy as point and click. And a very helpful Auditor that simplifies the job of documenting and analyzing worksheet logic.

Of course, you won't just like what Release 2.3 does. You'll like how it feels. It's quick and smooth. With a WYSIWYG (what-you-see-is-what-you-get) graphical environment that lets you format text, data, and graphics "live" on screen. With the mouse, you can execute commands, highlight cells or ranges, open dialog boxes, place and size graphs, change type styles, fonts and point sizes. All with unparalleled speed and ease.

What's more, Release 2.3 gives you a wide range of printing and reporting capabilities. Including the capacity to place as many live graphs on a worksheet as you'd like.

Along with 96 type style combinations, drop shadows, new 3D-effect graphs, drawing and annotation tools, and the most font support, choices of colors and shading available.

Compatibility? As with any 1-2-3 product, it's no problem. Because Release 2.3 will read all of the files you've created on previous versions of 1-2-3, including files you've formatted using Allways™ and Impress™. So you'll preserve all your work, as well as your training.

For more information see your Lotus Authorized Reseller. For a free demo or to order your upgrade directly from Lotus® call 1-800-TRADE-UP, ext. 6081.



What's New In Lotus 1-2-3 Release 2.3.

- A WYSIWYG graphical environment with live on-screen formatting
- Lotus Magellan viewer technology for fast file previewing, retrieving and linking...all without leaving your active worksheet.
- More graph types, including 3D-effect graphs and graph annotation capabilities.
- Auto Compress, for a trouble-free way of making larger worksheets print on single page
- Dialog Boxes for an easier, more interactive way of working
- Text-editing for easy on-sheet word processing, including automatic word wrap, even around graphs
- The Auditor for documenting or highlighting your spreadsheet logic
- Improved memory management for building larger worksheets up to 12 MB in size
- New printer drivers that support all leading laser and dot-matrix printers
- Context-sensitive, interactive Help and an on-line tutorial

*Please have your credit card and product package ready when you call. In Canada, call 1-800-668-1509.

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The new Lotus 1-2-3 for DOS



Introducing the new It will create your next Not to mention

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South America
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- Market analysis
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The new Freelancer Graphics for DOS offers a WYSIWYG (what-you-see-is-what-you-get) environment where you work with actual colors and fonts while you're creating your graphics. And with the mouse you can do it all in record time.

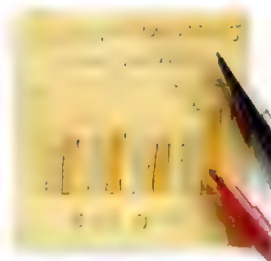
Automated Smart Features make it easier than ever to produce everything from simple word charts to impressive flow charts, diagrams and other business drawings.

Freelance Graphics. presentation beautifully. automatically.

Now there's an even better version of Freelance® Plus, the award-winning graphics program praised by *PC Magazine* and *PC World*. It's so improved, in fact, we even changed its name. Introducing Freelance Graphics™ 4.0. The best presentation graphics program for DOS.

For starters, we've added a graphical WYSIWYG environment. Which means you'll work with actual colors and fonts while creating your graphics. Plus, you'll know what your output will look like before you print.

And with the mouse you'll do it all—from executing menu commands



Only Freelance Graphics, with its unique automated Smart Features, can turn your rough ideas into a smooth presentation this easily.



to moving a chart—in record time.

Yet what's really unique about the new Freelance Graphics is its *Smart Features*. Unlike other DOS graphics programs, its hard-working *Smart Features* automate the process of turning your ideas into persuasive presentations. So while

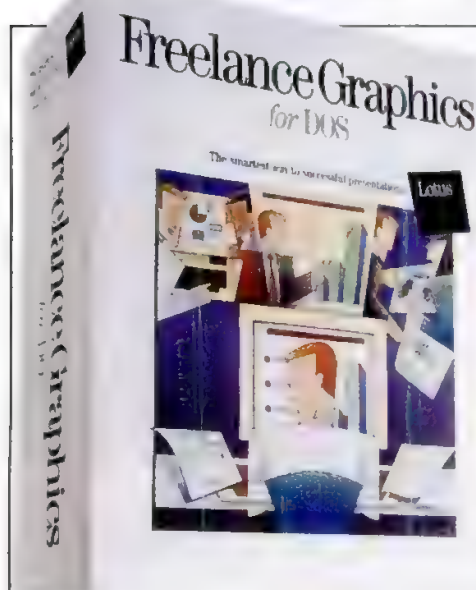
you're concentrating on what you want to say, Freelance Graphics will take care of how it looks. Whether you're creating slides, overheads, or hard copy, in color or black-and-white.

Here are a few of its *Smart Features*: **Portfolio**, a built-in presentation manager,

helps you organize and prepare your presentation; a **Text Chart Outliner** complete with a spell-checker, creates stacks of text charts in seconds; **Auto-charting** makes weekly or monthly reporting a snap by printing hundreds of up-to-date charts with a single command; **Smart Chart Update** automatically recomposes a chart whenever the data changes...even if you've added annotations or symbols; and over 1,000 **Pre-drawn Symbols and Design Backgrounds**.

All of which means you can now create an incredibly impressive presentation. With incredible speed and ease. The new Freelance Graphics.

It could actually have you looking forward to your next presentation.



Upgrade to Freelance Graphics now and you won't just save time. You'll save money.

Right now we're offering—direct from Lotus®—a price of just \$99.00* for anyone upgrading from an earlier version of Lotus Freelance or Graphwriter, or any other eligible† graphics program, including Harvard Graphics.

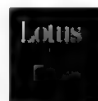
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For information or to purchase your upgrade directly from Lotus, call us.† Please have your credit card and eligible product package ready.

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†Developed by Symantec Corporation, especially for Freelance Graphics. *Offer expires September 30, 1991 after which the Lotus direct upgrade price will be \$119. †Eligible products for upgrade offer include all versions of the following products: Lotus Freelance Plus or Graphwriter, Harvard Graphics, DrawPerfect, Applause II/Draw Applause, Graph Plus, Charisma, Micrograph Chart, Plus, Gem Series, ChartMaster, Inagraw Master. ‡Freelance Graphics Upgrade also available at participating Lotus resellers.

Freelance Graphics for DOS



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Ami Pro for Windows

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4. Easiest-To-Use.
We've worked hard to consistently improve ease of use with each new version of Lotus software. And the hard work has paid off. When tested against competitors in independent research, customers have said that

our products are easier to learn and use than other products in their categories. It's that simple.

5. Outstanding Output.
We've designed our current products to deliver the highest quality output. With mouse support and an on-screen "What-You-See-Is-What-You-Get" formatting environment, Lotus products let you incorporate a wide array of fonts, hundreds of colors, images, graphs, even free-hand drawing.

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Every Lotus spreadsheet and graphics product is "network friendly," with a built-in ability to share files across a network. What's more, we've developed node and server versions of these products to help organizations better manage networking.

7. Technology Guarantee.
To help you exploit new technologies, we upgrade our products on an on-going basis. For just \$49, you can upgrade from any PC version of 1-2-3, Symphony,* Freelance Graphics™ or Ami Pro to any new version that comes out from Lotus within 6 months of your purchase. Which

means it's always a good time to buy from Lotus.

8. Thousands of Enhancement Products.
So popular are Lotus products that a whole industry has sprung up around them. Look through any PC magazine and you'll notice how many different software vendors are providing add-in products and templates specifically designed to enhance and support our products. And there are hundreds of training books and classes available as well.

9. Most Complete Platform Coverage.
Lotus spreadsheet products are available on and take full advantage of more platforms than any other software. This includes DOS, OS/2, UNIX*, mainframes, workstations, laptops and palmtops.

10. Around the clock "live" support for spreadsheet users.
Unlike any other software company, only Lotus offers its spreadsheet users 24-hour support, 7 days a week, 52 weeks a year. Just call us directly and you'll get help right when you need it most.

Whether you work with numbers, words or graphics. Whether you work alone or with other software users in a workgroup. Lotus has a product that can help you work better. So choose Lotus. And be confident you're working with the best products money can buy.



MAKING CHOICES

This overview concentrates on the five products' e-mail gateways and how they affect the various e-mail packages' administrative functions. For obvious reasons, you cannot mix one package's e-mail program with another's gateway. If you are already committed to a given e-mail system on your LAN, you're pretty much locked into the gateways that go with it. We did not select an Editors' Choice from among these gateway packages because the gateways themselves are not directly competitive. If you have not committed yourself to an e-mail package, you should refer back to our earlier look at e-mail for a discussion of the programs' features.

For administrative features on gateways, consider issues such as the quality of the manuals and options in the gateways for updating directories of users across multiple LANs and across multiple post offices on a single LAN. The scalability of the base e-mail product is also an issue. Look for proprietary choices and additional gateways beyond MHS, either currently offered or still under development.

Finally, note that the gateway packages we examined generally use several different models of delivery systems for the post offices on a single LAN. Some of these models allow three delivery tiers: *hosts*, in which any message sent to another user on the same host is immediately available; *domains*, in which messages must move through an intermediate post office to go from one host to another; and *multiple domains*, which normally require two intermediate post offices to send a message from a host in one domain to a host in another. Other packages, meanwhile, make no distinction between a host and domain. Moreover, most packages invent their own terminology and assign their own meanings to the exact same terms.

When planning to make electronic mail an integral part of your communications scheme, the important trick is to first find an e-mail or workgroup software package whose overall functions, including gateways, most closely match your particular needs. By carefully considering administrative and scalability issues when weighing your choices, you can help ensure that you will not soon outgrow the program nor be buried under a mountain of administrative details after you finally choose it.

cc:MAIL INC.

cc:Mail Gateway

by M. David Stone

When *PC Magazine* last looked at LAN e-mail software ("LAN E-mail Software," November 27, 1990), *cc:Mail*, Version 3.1, was a clear Editors' Choice, thanks to its long list of features and its appropriateness for both large and small networks. Not surprisingly, Version 3.20 from cc:Mail (a division of Lotus) also scores well in this focused look at gateways and administrative features.

Arguably the hardest part of setting up a *cc:Mail* e-mail system is figuring out which modules to buy. The base package, the *cc:Mail* Platform Pack, costs \$195 for the DOS version or \$495 for the *Windows*, *OS/2*, or *Macintosh* versions. Each Platform Pack lets you install one *cc:Mail* post office, with no distinction between host and domain. For this review, we looked at the \$1,295 gateway module, *cc:Mail Gateway*, in conjunction with both the *Windows* and DOS-based platform

packs. The gateway is a standard character-based DOS program. By itself, either Platform Pack will let you set up one local user. To add more, you must install one or more user packs, in units of 8 users for \$195 or 25 users for \$595. Each user pack allows you to add these users to only a single host.

cc:Mail Gateway enters the picture when you want to exchange messages with other domains, whether on the same LAN or other LANs. The gateway package handles asynchronous communications to other *cc:Mail* systems, and includes MHSLink, its MHS gateway. The \$1,295-per-use price of the package usually means per LAN, since a single package can move mail among all domains on one LAN (of course, there are situations where you might want to have more than one gateway package on a single LAN).

The proprietary gateway in *cc:Mail Gateway* can support all *cc:Mail* features available on a single LAN, such as automatic directory updates. It also notifies users of the successful delivery of messages to recipients on the other side of the gateway. Neither of these features is available when sending messages through *cc:Mail's* MHSLink, not because of the package's MHS gateway, but because of limitations in MHS.

The gateway machine needs to be dedicated, whether you use the proprietary gateway or the MHS gateway; you can use either an 8088-based workstation for communications below 9,600 bits per second, or a 6-MHz 286 or better for 9,600 bps or above. *cc:Mail Gateway's* proprietary gateway runs on all versions of *LAN Manager*, *NetWare*, *VINES*, and all *NetBIOS* networks, as well as *AppleTalk* 6.0.3 and 7.0.

If you have more than one *cc:Mail* domain, you will almost certainly want *cc:Mail Automatic Directory Exchange* to update directory information and bulletin boards throughout the *cc:Mail* system. The package costs \$995 per host.

MIX-AND-MATCH MODULES

Other modules you may be interested in that we did not test for this review include a calendar and resource-scheduling package (\$395 for five DOS users on one host, plus an additional \$595 for all *Windows* users on that host), a fax gateway (\$1,995 per gateway), and gateways for MCI Mail (\$1,295 per gateway), PROFSlink (\$2,200 per gateway), EZLink (\$695 per gateway), SprintMail (\$695 per gateway),

FACT FILE

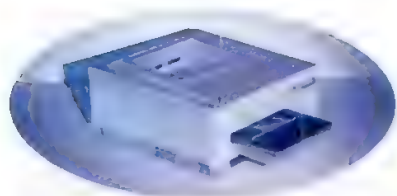


cc:Mail Gateway, Version 3.20
cc:Mail Inc., a division of Lotus Development Corp., 2141 Landings Dr., Mountain View, CA 94043, 800-448-2500, 415-961 8800.
List Price: \$1,295 per use. *cc:Mail* Platform Pack (for 1 user) for DOS, \$195; Platform Pack for *Windows*, *OS/2*, or *Macintosh*, \$495.
Requires: 320K RAM, DOS 3.1 or later, *cc:Mail* Platform Pack, *NetWare* or *NetBIOS* operating system (for proprietary gateway) or *NetWare* operating system (for MHS gateway).
In Short: *cc:Mail* is a full-function e-mail system with a great deal of flexibility in setup and administration. The proprietary gateway in the *cc:Mail Gateway* option supports all the e-mail features available on a single LAN. Somewhat odd, while the proprietary gateway is packaged together with the MHS gateway, the *cc:Mail Automatic Directory Exchange* is a separate option. All told, the program is easy to set up and administer, but the manuals are often more confusing than helpful.

CIRCLE 614 ON READER SERVICE CARD

All things being equal, they're not.

They're just about the same price. They're made by two very good



*Hewlett-Packard LaserJet III. \$2,395***

companies. Yet, there is one thing that makes

NEC's Silentwriter[®]2 Model 90 look much better on

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*NEC Silentwriter2 Model 90
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pay an extra thousand dollars*. Which you'd be crazy to do when you consider

how much NEC's Silentwriter has going for it. Like screen fonts, a standard

2MB memory, an Apple Interface[®], the ability to do envelopes, and the richest

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Silentwriter is a registered trademark of NEC Corporation. Adobe and PostScript are registered trademarks of Adobe Systems, Inc.

For product literature, call 1-800-NEC-INFO. NEC's Silentwriter2

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Model 90. Take a close look and you'll find it has no equal.

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CIRCLE 375 ON READER SERVICE CARD

EVOLVING E-MAIL: Will Client/Server Get the Message?

by Rick Ayre

These days, the talk in e-mail circles is of the mix of front ends and message formats that client/server architectures will allow. Making news lately are Beyond with its *BeyondMail* and @Mail, Reach Software Corp. with its *MailMAN*, and Software Publishing Corp., which has bundled e-mail handling into its new *Windows* word processor, *Professional Write Plus*. All of these products are part of the evolution of e-mail towards a client/server architecture.

In general, the client/server model splits the functionality of software between a back-end server and a front-end client. Usually, the term is reserved for those applications intelligent enough to store something on the server and provide the client only with what it needs.

On a simple level, client/server e-mail unbundles the traditional e-mail package. The back-end e-mail engine separates from the front-end user interface. Gateways such as those in this review play a prominent role in the client/server model. They usually come unbundled, hang off the e-mail engine, and serve as a local e-mail system's interface to the world. This may seem a simple concept, but it has dramatic implications for developers of front-end, back-end, and gateway products.

Front-end companies will be able to focus on developing the user interface. They can turn their attention to developing front-end tools that expand the role of e-mail. Hot topics in this area include user agents, as embodied in *BeyondMail*, and mail-enabled applications, typified by *MailMAN*.

Meanwhile, back-end companies can concentrate on efficient and easy-to-administer engines. The engine must be able to assume responsibility for directory services, message storage, and transport services. Developers of these engines will provide administrators with the tools they need to manage their mail systems effectively.

Since gateways under this scenario typically come unbundled, gateway developers can focus on connectivity to MHS, X.400, PROFS, and SMTP in the same gateway. Standards like MHS and X.400 become even more crucial in the era of client/server e-mail: There can be no surprises between the sender's front end and the receiver's.

BEYOND MAIL AND @MAIL: TWO STEPS BEYOND

Beyond sells two products that push e-mail into the next generation. @Mail, a \$129.95 e-mail front end, works from within *Lotus 1-2-3* and *Symphony*. Another e-mail front end, the \$695.00

.

BeyondMail, offers advanced routing capabilities and is scheduled for release this summer.

@Mail is a niche product that may herald a new category of software additions. Because of the way @Mail is integrated into *1-2-3*, you can use the menus you know and love when working with your e-mail messages. The program also makes it easy to share and collaborate on *Lotus* files via e-mail while developing *1-2-3* models.

The best feature of @Mail is its use of the *Lotus* macro language. Using programmed macros, you can create a data-driven application. You could, for example, automatically congratulate all sales personnel through e-mail once the value in a spreadsheet cell goes beyond a certain number.

The upcoming flagship of the Beyond line, *BeyondMail*, will introduce

technology new to the commercial e-mail market. It draws on research licensed from MIT Information Lens and originally used in an MIT project called Object Lens.

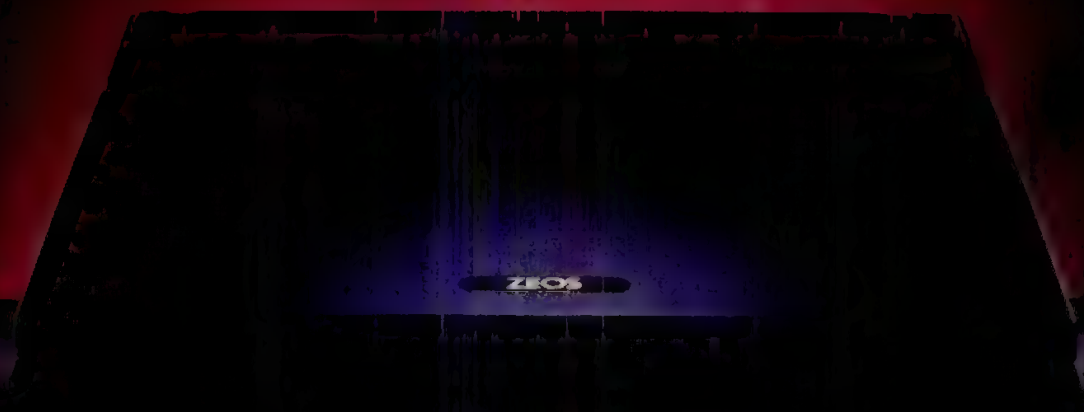
Beyond heralds its product as the answer to chronic information overload. *BeyondMail* uses information in the e-mail header and text as filters to route mail in an intelligent way. It can place the mail you most want to read in your Urgent folder, and forward mail for you automatically. The product lets you make your e-mail world behave the way you want it. @Mail uses *Novell MHS* as the back-end server; *BeyondMail* will too, when it ships.

MAILMAN: E-MAIL MANAGEMENT UNDER WINDOWS

The MAN in *MailMAN* is capitalized because MANAGEMENT is what Reach Software stresses. *MailMAN* is a \$995 *Windows*-based application designed as a client front end to manage workflow. It provides for such basic e-mail message services as the creation and editing of text, the addressing and routing of envelopes, and the use of attachments. When integrated into workflow management applications, *MailMAN* serves as an agent for the routing of electronic objects such as text or images among various users and applications.

MailMAN relies heavily on the *Windows* environment to deliver its functionality. Support for *Windows* DDE (dynamic data exchange) and OLE (object linking and embedding) form the backbone of *MailMAN*'s object-flow management. Even its ability to launch applications relies on a *Windows* feature. Although *MailMAN* is currently available for *VINES* networks only by using *Banyan*'s proprietary back-end engine, Reach promises that upcoming versions will use MHS on *NetWare*, and popular e-mail back-end engines such as *Lotus*'s *cc:Mail* on *LAN Manager* networks.

CONTINUES



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"There's a new king of the hill—the ZEOS Notebook..." — **PC Magazine, Editor's Choice** ■

"ZEOS' Notebook...it's the one to buy..." — **PC World, Best Buy** ■ *"The ZEOS Notebook...a*

clear winner...why settle for less?" — **Byte** ■

"This notebook is a steal." — **InfoWorld** ■ *"The ZEOS beats the Compaq."* — **PC Computing**

■ *"The ZEOS Notebook...delivers astonishing value...sensational."* — **Portable Office** ■ *"An*

outstanding value." — **PC Week**

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Either way, you're sure to appreciate our light weight snap-in, snap-out battery packs. They're so light and easy to use, you can easily take an extra one with you on those really long trips. You can get even more life out of a single charge by using our programmable power management system. Hour upon hour of Notebook computing power!

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Your new ZEOS notebook is a great connectivity tool. Utilizing our optional built-in 2400 baud MNP Class 5 modem, connectivity buffs will find themselves logging on at every turn. And speaking of connectivity, we've kept the I/O easy to use too. Because unlike many of the others, your new ZEOS notebook has the same industry standard port connectors you'll find on your larger desktop system. Completely compatible! Serial and Parallel ports; even an external VGA connector. All industry standard and ready to go the minute you receive your system.

It's attention to detail that makes the difference. Tens of thousands of hours of development time have been invested. We've been thinking and re-thinking exactly what you want in a notebook, and now we're building it for you. We think you'll agree, it's an incredible product. Plus, your new notebook is backed by the best support in the industry, 24 Hours a Day.

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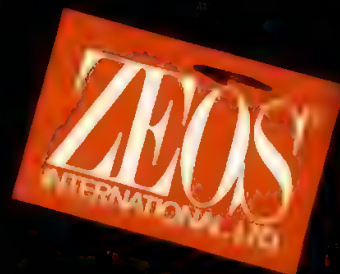
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The ZEOS Guide to the Perfect Notebook:

✓ **PROCESSOR:** PC Magazine recommends a '286 or '386SX processor pointing out that "8086- and 8088-based portables have only half to a third of the computing power of a 286." That's why ZEOS offers you your choice, '286 or 386SX! More power for you. After all it's just like a 6.5 pound desktop!

✓ **DRIVES:** *Two drives, built in!* A whisper quiet high speed 20 Megabyte hard disk *plus* a 1.44 Megabyte 3.5 inch floppy. Remember, with a built in floppy drive you don't need to fool around with strange interfaces to load and transfer files.

✓ **VIDEO:** ZEOS raises the ante to VGA! We're talking about bright and crisp VGA displayed on one of the largest notebook screens in the industry. The display also features advanced fluorescent backlighting, 32 grey scales and 640 x 480 resolution. Plus, it can be adjusted to any position over a 135° angle and features easily adjustable brightness and contrast controls. Easy viewing under virtually any lighting conditions. You can connect to an external VGA color monitor too!

✓ **GREAT BATTERY FEATURES:** Every battery feature you want. You can plug your notebook in and "quick charge" the battery in less than one hour or you can "trickle charge" while in use. Plus, your battery easily snaps out allowing the quick installation of an optional replacement battery. It's great to be able to carry a light weight spare for those especially long trips. An optional battery charger stand is available as well.

✓ **INTELLIGENT POWER MANAGEMENT:** Your new ZEOS notebook features an intelligent programmable power management system if you wish to use it. Based on the length of time since your last keystroke, you may reduce CPU speed, display screen backlighting etc. Full power is immediately restored at the stroke of any key. The system even knows *not* to use the power management system when you are operating on AC power!

✓ **SYSTEMS STATUS AT A GLANCE:** Yes, monitor eight key system components at a glance! We've equipped your new notebook with eight LED indicators which monitor disk access, keyboard functions and power status. There is even an audible alarm

which may be programmed to inform you of a low battery condition and to let you know if the cover is closed with the power on. Now that's one smart notebook!

✓ **DESKTOP KEYBOARD FEATURES:** We're talking 82 full size keys with full 101-key emulation. And the keyboard isn't squeezed either. The distance between the "Q" key and the "[" (left bracket) key measures 7.5 inches, just as PC Magazine suggests. The keys are of standard size, plus touch typists will love our full 3.5mm keystroke. Type for hours and love it!

CHECK IT OUT!

Now, you can take desktop computing power anywhere! Your ZEOS notebook has many features of obvious importance. Also, there are a number of features that are subtle yet critical to your ultimate satisfaction. We'll go over them here one by one. We think you'll agree your new ZEOS Notebook is the one for you!

✓ **CONNECTIVITY AND I/O:** Keeping in touch is easy when you order our internal 2400 baud MNP Class 5 modem. Simply plug in the phone line and dial away. How about I/O ports? Many notebooks don't have them and if they do they're often non-standard. But your ZEOS notebook has *industry standard* I/O—serial, parallel and VGA. Just like your desktop!

✓ **FCC & UL APPROVALS:** Your new ZEOS notebook features both FCC Class B and UL approvals. We've also met CSA and VDE requirements too, just for good measure. Quality and reliability.

✓ **WATCH THE DETAILS TOO:** Like memory expandability. One Meg comes standard, you can also order a total of 3 or 5MB as a factory option. And lots of other details. Like a recessed power-on reset button, a soft carrying handle, built in speaker and more. You're going to love it! And there's no reason to wait.

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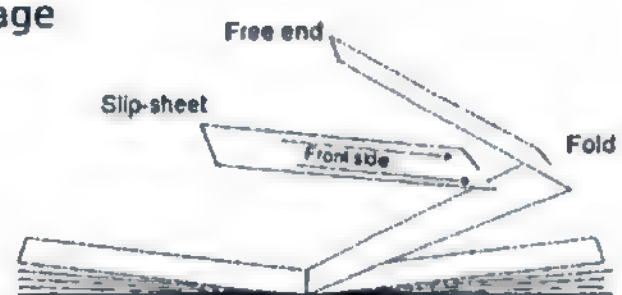
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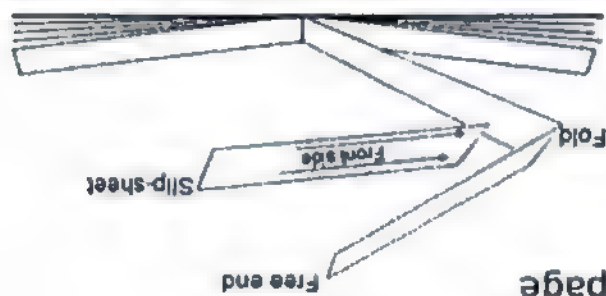


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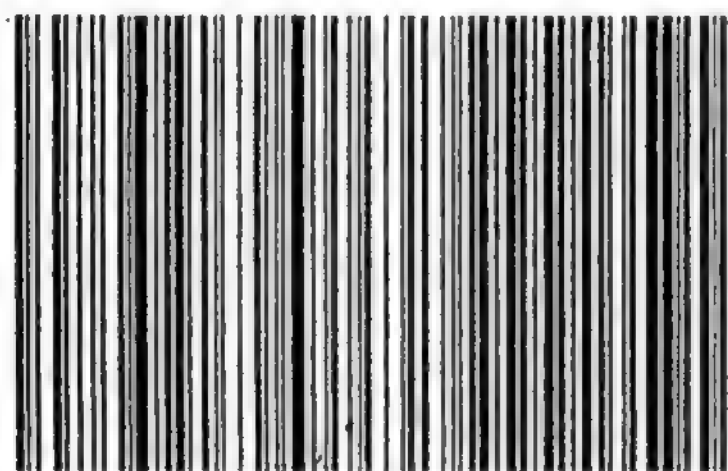
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1. Follow instructions on the other side

Inverted Back



Gbs5lip8ack-0018

Back

1. Follow instructions on the other side



**"THE HOTTEST DEAL
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As PC Magazine said, the ZEOS Notebook "offers a top notch combination of power, weight, features and price..." And you can pick your power! Choose our '286 version or go for the incredible new ZEOS '386SX. Combine either with our high speed hard disk, built in 1.44MB floppy drive, VGA and more—you've got the greatest notebook going at any price!

INCREDIBLE DESKTOP FEATURES IN A NOTEBOOK.

In fact, it's really like owning a full featured desktop that you can take with you anywhere! Look closely at the details. Like our crisp 10" VGA display. The ultimate in sparkling clarity, it features advanced fluorescent backlighting for vivid VGA graphics. Then, the drives.

Two drives are better than one!

First, your notebook will include our whisper quiet high speed, high capacity hard disk. It will read and write your data so fast chances are you'll hardly know it's there. Then we're building in an industry standard 1.44 Megabyte 3.5 inch floppy as well.

While most notebooks don't include a floppy drive at all, you're really going to appreciate your ZEOS notebook's industry standard 3.5" floppy. It makes loading software and transferring files a breeze. Simply toss in your 1.44 and it's done. Anyway, can you imagine a desktop system without a floppy? We couldn't either. That's why your ZEOS notebook has one. It's great!

But the features of your incredible new ZEOS Notebook don't just stop there. Detail after detail we're giving you more than anyone else. Much more, for much less. Take a closer look.

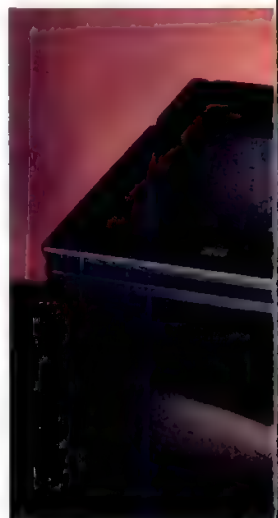
DETAILS MAKE THE DIFFERENCE!

For instance, the battery system of your new notebook is the most advanced on the market. You can quick charge, or trickle charge, any time your system is plugged in. You can also take the battery out and use the optional charging stand if you wish.

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**Now, you can
computing power
The incredible ZEOS**



10 Good Reasons To Buy From ZEOS®

Reason #1

"Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but *seven* times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editor's Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent."



Value: Excellent."

Personal Computing said, "ZEOS... is the best value we've come across... its performance is right up there with the slickest, most expensive PCs you can buy."

Reason #5

Warranties and Guarantees.

ZEOS believes in its products. That's why we offer each and every customer our 30 Day Absolute Satisfaction Money Back Guarantee, no questions asked. Plus, our One Full Year Limited Warranty and Express Parts Replacement Policy. Optional On Site Service is available too. Call for details.

Reason #6

24 Hour Toll Free Technical and Sales Support.

At ZEOS, the customer is #1. That's why we invented 24 Hour a Day Tech Support. For *your* convenience. If you buy a product from us we feel we should be there to help, any time of the day or night. Give us a call Toll Free! 800-423-5891. Anytime!

Reason #7

Experience.

Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

Easy to Buy.

ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, Discover, American Express, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

And now the Z-CARD! It's your very own ZEOS Credit Card and you can apply today. With the Z-CARD you can charge your ZEOS purchases and pay in easy monthly installments. It's just like a Bank Card. Why not apply for your Z-CARD now!

Reason #10

You're Going to be Very Satisfied.

When it comes right down to it, you're going to be very satisfied with your new ZEOS system. Our goal is your complete satisfaction. And that's our commitment to you. To quality. To performance. To reliability and support. To *Value*. We don't just say it, *we Guarantee it!*

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St. Paul, MN 55112. We'll give you a call as soon as your credit line is established!*

Please complete all appropriate sections, *providing at least two years residence and employment history*. **THIS IS NOT A CREDIT AGREEMENT!** One will be sent to you upon authorization of an account. (This Form Must Be Signed To Process Your Order.) All Financed Purchases Are Subject To Credit Approval. **If You Have Any Credit Questions, Please Call 800-421-8942 For Assistance. Thank You!**

A married person may apply for individual credit. I am applying for (please check appropriate box):

- ☐ **JOINT CREDIT** with another person. Complete entire application.
- ☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
- ☐ **INDIVIDUAL CREDIT.** Do not complete Section C.**

**If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS: YOU MUST DISCLOSE YOUR MARITAL STATUS:

☐ married ☐ unmarried ☐ legally separated

A. YOUR PERSONAL INFORMATION

Name _____

Home Phone (_____) _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____

Previous Address _____

City _____ State _____ Zip _____

Employer _____ Since? (Mo./Yr.) _____

Monthly Gross Salary \$ _____ Daytime Bus. Phone (_____) _____

Previous Employer _____ From - To _____

Occupation _____

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income \$ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____ Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE: Checking Account ☐ Yes ☐ No Savings Account ☐ Yes ☐ No

	Y/N	How Many?	Y/N	How Many?
Bank Loan	_____	_____	_____	_____
Dept. Store Charge Card	_____	_____	_____	_____
VISA	_____	_____	Credit Union Account	_____
MasterCard	_____	_____	Other Major Charge Cards	_____
Finance Company Loan	_____	_____		_____

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (_____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (_____) _____ Monthly Gross Salary \$ _____

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I authorize ZEOS International, Ltd. or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct to the best of my knowledge and belief.

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Date _____

Joint Applicant's Signature _____

Date _____

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There are costs associated with the use of this credit card. To obtain more information about these costs, call us at 800-421-8942 or 612-635-0613 or write to ZEOS, Z•Card Processing Center, 530 5th Avenue N.W., St. Paul, MN 55112.

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Will Client/Server Get the Message? (CONTINUED)

PROFESSIONAL WRITE PLUS: E-MAIL FOR WORD PROCESSING

Software Publishing Corp.'s \$249 *Professional Write Plus* demonstrates that the company also understands the potential for building e-mail front ends into applications. Although SPC's program is a Windows-based word processor, not an e-mail package, the full-featured e-mail front end inside *Professional Write Plus* facilitates sending and receiving messages, including *Professional Write Plus* documents. You can also insert graphics or selected text from your documents in the message.

The e-mail capability works from inside the word processor, using Windows dialog boxes. By selecting a menu choice, you can invoke the e-mail front end. *Professional Write Plus*'s e-mail functions include all of the features that you would expect in a standalone e-mail package, including mail notification and an address book. The e-mail capability works by attaching to *Novell MHS*.

Documents can be group efforts, and users can easily pass them to each other while working within the word processor they use to create and edit them. Missing from *Professional Write Plus*, however, are any special e-mail editing features, like redlining to keep track of which user made edits in a document, or any form of version control. On the other hand, the complete e-mail package is yours for the price of the word processor, which is inexpensive to begin with.

Client/server architecture has been the buzzword in network databases long enough for people to wonder if the year of client/server will prove as elusive as the year of the LAN. But in the e-mail world, these four packages show that the long-awaited year may be very near. ■

BeyondMail, Version 1.0
@Mail, Version 1.0
Beyond Inc., 38 Sidney St.,

Cambridge, MA 02139; 617-621-0095.

List Price: *BeyondMail*: Server Edition (includes one-user license), \$695; 5-node expansion pack, \$395; 20-node expansion pack, \$1,395; Remote Access Edition (single-user), \$250. *@Mail*: Starter Kit (includes one-user license), \$129.95; 1-node edition, \$79.95; 8-node expansion pack, \$395; 24-node expansion pack, \$795. **Requires:** *BeyondMail*: 286-based compatible or better; 1MB RAM; DOS 3.1 or later; *ELS* 2.15, or *Advanced NetWare* 286 or 386 2.15 with *MHS* 1.1 or later. *@Mail*: 120K RAM above 1-2-3; DOS 3.1 or later; *Lotus* 1-2-3, Release 2.01, 2.2, or 2.3; *Symphony*, Release 1.1, 1.2, 2.0, or 2.2; *EMS* 3.2 or later; *ELS* 2.15, or *NetWare* 2.15 with *MHS* 1.1 or later. 286-based compatible recommended.

CIRCLE 611 ON READER SERVICE CARD

MailMAN, Version 1.0

Reach Software Corp., 330 Portrero Ave., Sunnyvale, CA 94086; 408-733-8685.

List Price: For *VINES*: 20-user version, \$995; unlimited-user version, \$1,995. **Requires:** For *VINES*: 286-based PC or better, 640K conventional memory and 256K extended memory, DOS 3.1 or later, *Microsoft Windows* 3.0, *VINES* 4.10, *VINES* mail service running on a Banyan-certified mail server, *VINES*-supported PC-LAN interface card. Mouse optional.

CIRCLE 612 ON READER SERVICE CARD

Professional Write Plus, Version 1.0

Software Publishing Corp., 1901 Landings Dr., Mountain View, CA 94043; 415-962-8910.

List Price: Unlimited single-user version, \$249. **Requires:** 286-based PC or better, 1MB RAM (with grammar checker, 2MB), hard disk, *Microsoft Windows* 3.0 or later. Mouse recommended.

CIRCLE 613 ON READER SERVICE CARD

X.400 (\$1,995 per gateway), SMTP (\$2,995 per gateway), and Soft-Switch (\$995, for use with *SNADS Gateway/cc:Mail* from Soft-Switch). You can also get *cc:Mail Remote*, a \$295 package that lets standalone PCs call into a network host post office.

Clearly, these mix-and-match modules give *cc:Mail* a great deal of flexibility. Similar flexibility shows up in most of the package's administrative functions, including the choices for administering the gateway. You can, for example, set the proprietary gateway as peer-to-peer, with either side able to initiate a call, or as master/slave, with one side initiating all calls. Similarly, you can set the directory update feature as peer-to-peer, with changes made in one post office directory going to another, or as master/slave, with changes in the master post-office directory sent to the slave directory, but not vice versa. Even better, you can use a different scheme for message routing than for directory updates. For example, you can set up ten offices with one master serving as the hub placing all calls, and establish a peer-to-peer relationship for updating addresses in directories throughout the system.

Once you have determined which modules your organization needs, setting up a *cc:Mail* system is remarkably straightforward. Each module, including the *cc:Mail Gateway* option, comes with an installation program; the installation programs and most administrative tasks are self-explanatory.

In terms of security, *cc:Mail* maintains all messages in a single database in an encrypted format, and retains that encryption when sending messages through *cc:Mail Gateway*'s proprietary gateway. As administrator, you can assign passwords to the gateway but cannot turn off message encryption. You can also set how often messages are sent through the gateway. Since *MHS* does not support message encryption, this feature is not available when you use *cc:Mail Gateway*'s *MHSLink* to send messages.

CONFUSING MANUALS

The one important problem in this package is the manuals. Installing and maintaining *cc:Mail* may be easier if you ignore the manuals whenever possible. The Platform Pack, for example, comes with an administrator's learning guide that spells out the host directory structure and tells you to create the directories, then



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You just have to know the way to your nearest dealer. Because the Intel SatisFAXtion™ fax board is

now available at dealers everywhere.

When we released the SatisFAXtion board, we had no idea it would create the kind of demand it did. But considering all it has to offer, like one-step, complete background faxing, minimal memory requirements, Windows* 3.0 compatibility, and a MNP5 modem—all for a mere \$499 list price—it's no wonder everyone was trying to find it.

If you'd like to learn more about the hottest product on the market and the new Intel hand scanner that's now available, call (800) 525-3019 and we'll fax you document #9994. If you'd like us to point the way to your nearest dealer, call (800) 538-3373.

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CIRCLE 374 ON READER SERVICE CARD

load the administration program. Unfortunately, it fails to mention the installation program that can do all this for you. Only the reference manual describes the installation program. This oversight is typical of the *cc:Mail Gateway* manual as well.

If you need help, *cc:Mail* offers support weekdays from 7:00 to 5:00 P.S.T. at a toll-free number; you can also reach the company via its BBS. Easy setup, maintenance, and use can be found in every part of *cc:Mail* from host to gateway, simplifying the administrator's job. Its large number of gateways yield high marks for interoperability.

LOTUS DEVELOPMENT CORP.

Lotus Notes

Novell MHS Gateway

by Gary Berline

Lotus binds applications development with a heavy-duty communications core in Version 2.0 of *Lotus Notes*, its workgroup computing product. The tight integration produces some potent gateway features but demands equally powerful resources.

Lotus means big business and big networks: Prices for this modified client/server product start at \$62,500 for 200 licenses in any combination of clients and servers. All proprietary gateway functions are built into the basic package as part of the *Notes* server. Lotus's *Novell MHS Gateway* module (not to be confused with Novell's MHS package, *Novell MHS*) sells for \$2,500, and also installs on the *Notes* server.

The hefty \$62,500 ante delivers manuals, media, and five days of a system engineer's time. Six months of included maintenance covers upgrades and ID cards for four members of your organization, entitling them to phone support weekdays from 8:00 to 6:00 E.S.T. Each additional purchase of fifty or more units at \$395 per license includes one ID. Maintenance continuation costs 15 percent of the purchase price. Extra IDs cost \$500 each or \$3,000 for a set of ten. Organizations looking at *Notes* should consider the hardware needed. Upgrading an organization's workstations to run OS/2 or *Windows* 3.0 can raise the entry fee quickly.

CLIENT SERVER APPROACH

Notes builds its workgroup functions as applications based on shareable flat-file

databases, which users access through the client software on their workstations. The *Notes* interface employs a relatively intuitive CUA/SAA-compliant graphical menu system. System managers can perform administration on all of the available gateway types by using the client software at a workstation or loaded onto the gateway itself. *Notes*' adapted client/server architecture lets administrators (and users) work independently of the server, allowing for remote administrative maintenance of gateways, whether proprietary, MHS, or other.

Notes supports connections to most mini and mainframe e-mail systems via Soft-Switch's *Soft-Switch Central*, a host-

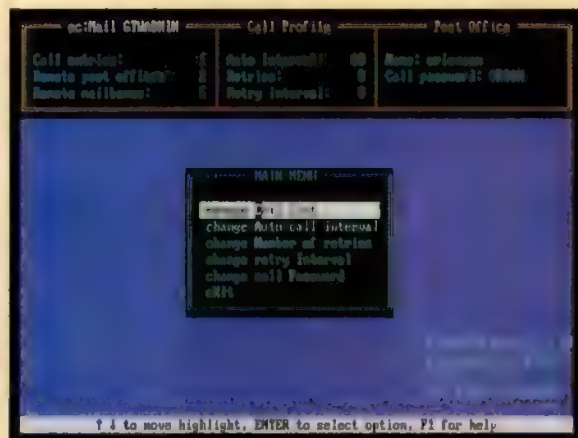
based gateway. Any product that supports MHS can access *Soft-Switch Central*, but Soft-Switch makes a direct gateway specifically for *Notes*. Lotus also markets software that provides connections to its own recently purchased *cc:Mail*. *Notes* servers can drive a DigiBoard multiport card, dialing out on one port while receiving calls on several others. Since the MHS gateway runs on the server, it may use the board concurrently with the proprietary gateway.

The server runs under OS/2 with NetBIOS. *NetWare* users will require the Novell OS/2 requester. *Notes* and its gateways run on all major NetBIOS-capable networks; its MHS gateway requires *NetWare* and the Novell OS/2 requester. Lotus may announce support for Banyan's

ADMINISTERING E-MAIL GATEWAYS

Every system administrator needs to be able to manage his or her e-mail gateways. This ability can be provided by the gateway package, or by administrative functions contained in the e-mail or workgroup software program. Important features for an administrator to consider are options for controlling how often the e-mail system exchanges messages with other systems; updating user directories; and setting

security privileges, routing alternatives, and priorities for sending messages across connected systems. Statistical information on the duration of message transfers or the number of errors incurred during a transfer can also prove to be valuable data for the administrator. Here is a sampling of the ways in which the e-mail products we reviewed implement some of these features.



The main menu in *cc:Mail Gateway*, shown in the center of the screen, offers options for managing your call list and for setting the call interval, number of retries, retry interval, and call password. Note the summary of current system settings conveniently displayed across the top of the screen.

CONNECTIVITY E-MAIL LAN LINKS

VINES around the time you read this. Macintosh client software lies further down the road.

Installation requires at least reasonable OS/2 knowledge. With it, the process breezes along for both servers and workstations, aided by clear prompts. The MHS gateway setup follows the same familiar path.

FAULT-TOLERANCE FEATURES

By storing its data on proprietary servers, controlling all functions from them, and using NetBIOS to provide LAN communications, *Notes* insulates itself from file-server failures on the network. Sys-

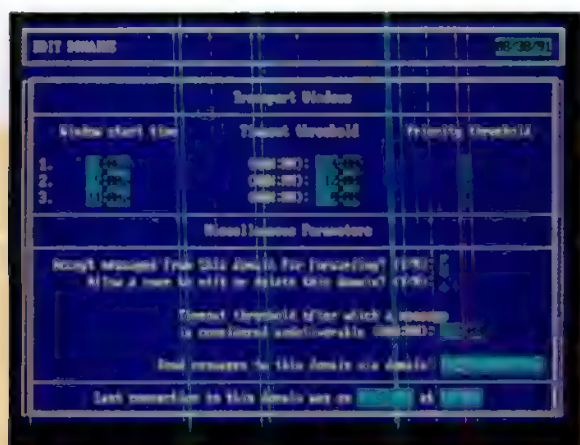
tem supervisors gain a valuable bonus in reduced downtime.

The first *Notes* server you create builds a file that contains user and network connection information as well as the mail schedule. Administrators set delivery to occur according to time, number of items, and priority.

While establishing new servers, you initiate a process called replication which, from that point forward, automatically duplicates databases among selected proprietary gateways, following a schedule you set. The user database, reproduced

throughout the system, becomes the Public Name & Address Book. The collection of servers using identical Public Name & Address Books forms a domain, as Lotus defines it. *Notes* domains often encompass large sections of an organization, if not every LAN in the enterprise, which expands past the bounds of our multiple-domain concept.

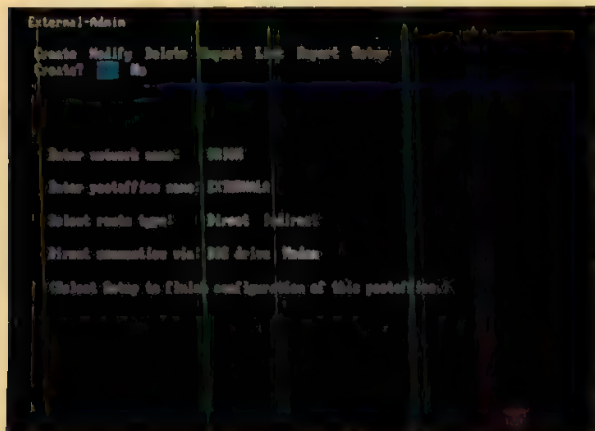
Administrators setting up new gateways in the same *Notes* domain can simply add the information to the Public Name & Address Book, vastly simplifying directory creation. That accomplished, replication duplicates this updated version throughout the system. In addition to



A menu in *Office Works Communications Option* lets you set a timeout threshold and a priority threshold for messages. If a message has been waiting for longer than the period of time set as a timeout threshold, it is sent. If it has been waiting only a short time, it is sent if its priority value exceeds the priority threshold.



Lotus Notes' security requires that users and the servers they log onto share a certifier ID. This screen shows a log file that keeps a record of certifications. The Public Name & Address Book can be set by the administrator to undergo replication so that newly updated books are copied to all servers in a particular domain.



Microsoft Mail for PC Networks lets you connect with other systems by modem or through a mapped drive on one of your servers. Indirect routes, where you send mail to an intermediate post office, can prove an efficient method of administration, since you can update information for various systems at a central site.



The *WordPerfect Connections* asynchronous gateway screen displays three sections. The right side of the screen shows the gateway status. Here, the gateway has just finished sending a 598-byte file. The upper left shows cumulative statistics, such as the time the gateway has been running. The lower left shows modem activity.

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FACT FILE

Lotus Notes, Version 2.0**Novell MHS Gateway**

Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 800-635-6887, 617-577-8500.

List Price: Lotus Notes for up to 200 users (any combination of clients and servers), \$62,500; additional units in sets of 50 licenses or more, \$395 per license. Novell MHS Gateway, \$2,500.

Requires: For OS/2 server, OS/2 workstation, or Windows workstation: 286-based PC or better, or PS/2 Models 60 or better; 6MB RAM (for OS/2 server; 9MB recommended), 4MB RAM (for OS/2 workstation), or 1MB RAM (for Windows workstation). For proprietary gateway: NetWare (with Novell OS/2 requester) or NetBIOS operating system. For Novell MHS Gateway: NetWare (with Novell OS/2 requester) network operating system.

In Short: A high-powered product that provides much more than e-mail, Lotus Notes comes with a price to match. Organizations intending to harness its might need thorough planning and an ability to sustain both the installation expense and the cost of ongoing maintenance for the proprietary gateway and the optional Novell MHS Gateway. Notes handily supplies the tools to manage its gateways and facilitate communications among widely dispersed users, providing a good return on the investment.

CIRCLE 615 ON READER SERVICE CARD

making directory updates painless, replication introduces a degree of fault tolerance through its redundant storage of information on geographically dispersed systems. Should any Notes servers drop out, the others attempt to find connections via secondary paths.

Notes provides excellent reporting capabilities, displaying and logging phone calls, ports, time of day, call length, and a wealth of other information for both MHS and proprietary gateways. Security based on RSA Data Security's public encryption-key method guards the system effectively, but can add administrative overhead because Lotus applies it to creating new users. Creating a new user takes several extra minutes solely because of the special encryption process.

Little of Notes' gateway functionality passes through Novell MHS because of that product's orientation as a basic message-exchange device. Replication and encryption head the list of victims. Nevertheless, Notes provides some powerful communications features that demand commensurate attention. The product puts

solid gateway management tools in your hands but requires a commitment to constant expert maintenance. Organizations large enough to devote the resources should see equivalent returns.

MICROSOFT CORP.

Microsoft Mail for PC Networks

Microsoft Mail Gateway to Novell MHS

by Rick Ayre

.....

Question: What looks and acts like *The Network Courier*, but is not *The Network Courier*? **Answer:** The new *Microsoft Mail for PC Networks*. The reason is that Microsoft recently acquired Consumers Software, makers of *The Network Courier*. Although Microsoft has big plans for the Consumers package, the first release of *Microsoft Mail* is basically a repackaged version of Consumers'. Regardless of its lineage, the product's gateway capabilities shine. This robust, high-powered e-mail system supports a wide variety of gateways and contains strong administrative features. It has to be among your top choices if you're designing your e-mail system from the ground up.

Microsoft Mail is sold in modules. The e-mail server costs \$695. Workstation packages come bundled for 5, 20, 100, and 500 users, and sell for \$395, \$1,395, \$5,500, and \$22,500, respectively. Gateways range in price from \$495 for the *Microsoft Mail Gateway to Novell MHS* (which we looked at for this review), to \$14,995 for IBM PROFS.

The proprietary gateway for connecting two separate *Microsoft Mail* installations comes bundled with the basic e-mail inter-networking package. Many other gateways, including IBM SNADS/DISOSS, MCI Mail, fax, and SMTP, as well as the MHS gateway, are available from Microsoft. An X.400 gateway should be available by the time you read this.

INSTALLING THE GATEWAYS

You install the proprietary *Microsoft Mail* gateway and the *Microsoft Mail Gateway to Novell MHS* on the e-mail server. Once either gateway is installed on the file server, you run it from a network workstation.

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The workstation need not be dedicated full-time to running either the proprietary or MHS gateway program, but when it's running either gateway, that's all that it can run.

We used a *NetWare* file server while evaluating the gateways, but the *Microsoft Mail* proprietary gateways can work on all major networks. To install either the proprietary gateway or MHS gateway, you use the same ADMIN program that you use to configure your local *Microsoft Mail* mail system. The workstation e-mail programs can run either in DOS character mode or under *Windows*, but the ADMIN program and gateways run only in character mode.

Installation is simple enough, but figuring out some of the terminology Microsoft uses is not. The manual for *Microsoft Mail* would be considerably more helpful if Microsoft sprinkled examples throughout the installation instructions, in place of the many confusing drawings of network configurations. You will need to read the administrator's guide from cover to cover before attempting to install either gateway.

On large installations you will almost certainly want to run the proprietary gateway to connect with like systems, and the MHS gateway to establish links with diverse e-mail packages. Using the proprietary gateway, you can take advantage of *Microsoft Mail*'s strong administrative features, such as the inclusion of detailed storage information (by users and by files), and the ability to delete (or age) messages based on various criteria.

Microsoft provides all of the administrative tools you need to manage your proprietary gateway effectively. The ADMIN program gives you flexible control over importing and exporting address lists, editing lists, and making lists available to mail users. Most of these tasks can be automated or done manually. (The ability to import address lists via the MHS gateway is a subset of the features of the proprietary gateway.) Also included is the ability to monitor phone usage through detailed communications logs.

Microsoft Mail provides a powerful script language to customize your proprietary gateway, to the point of letting you connect to more than one external post office at the same time.

TRANSLATING ADDRESSES BY HAND

Getting the MHS gateway to run is the easy part. Translating from the *Microsoft Mail* address scheme to the MHS scheme

CONNECTIVITY E-MAIL LAN LINKS



FACT FILE

Microsoft Mail for PC Networks, Version 2.1
Microsoft Mail Gateway to Novell MHS
 Microsoft Corp.,
 1 Microsoft Way,
 Redmond, WA 98052,
 206-882-8080
List Price: *Microsoft Mail for PC Networks* (e-mail server), \$695; user licenses range from \$395 for 5 users to \$22,500 for 500 users
Microsoft Mail Gateway to Novell MHS, \$495
Requires: For server: DOS 3.1 or later. For DOS workstation: 384K RAM, DOS 3.1 or later. For *Windows* workstation: 384K RAM, DOS 3.1 or later, *Windows* 2.1 or later. For proprietary gateway: *NetWare* or *NetBIOS* operating system. For MHS gateway: *NetWare*
In Short: *Microsoft Mail for PC Networks*' wide variety of gateways and strong, flexible administrative features makes its high-powered e-mail system a treat to use. A repackaged version of *The Network Courier*, its main drawbacks are a confusing manual and the fact that it doesn't automatically translate addresses from the *Microsoft Mail* addressing scheme to the MHS scheme when it is used in conjunction with the *Microsoft Mail Gateway to Novell MHS*.



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is long and drawn out. Because the gateway does not come with an automated translation program, almost all of the translation has to be done by hand. On a large network this would not be a trivial task.

Microsoft Mail allows any configuration you wish. The proprietary gateway can wait or call immediately, both sides can call and pick up waiting mail, or call and only deliver mail. The package is also flexible when updating users' address directories across the gateway. It can do it automatically, manually, or by picking from lists. Like all the programs we reviewed, when it uses the MHS gateway (here, the *Microsoft Mail Gateway to Novell MHS*), MHS handles the process of exchanging mail. The system administrator can specify whether MHS will wait to be called or initiate the call.

The program's polling for messages over the gateway is completely configurable. The default is once an hour, but you can select any increments you like or always stay connected to two post offices at once.

All messages sent via the proprietary gateway are encrypted (MHS, and so Mi-

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CONNECTIVITY

E-MAIL LAN LINKS

crosoft's MHS gateway, does not support message encryption). Not even the administrator can read private e-mail. The administrator can create subordinate or equivalent administrators, and make different views of the directories available to different users or subordinates.

Microsoft offers support by telephone over a toll number from 7:00 to 4:00 P.S.T. and on CompuServe. The company also plans to announce a premium support plan this summer.

It's hard to fault this program. Its few shortcomings, confusing terminology, and tedious MHS translation are certainly not unique, and its strengths are many. The package has options for nearly universal gateway support and includes excellent administrative tools; it also uses system resources very cost-effectively. Microsoft has another winner on its hands.

DATA ACCESS CORP.

Office Works

Communications

Option

Office Works MHS

Gateway

by Gary Berline

.....

Data Access Corp. aims *Office Works* at small and medium-size enterprises. The product is designed as a complete work-group automation solution; its e-mail gateway functions, provided by *Office Works Communications Option* and *Office Works MHS Gateway*, draw our attention here.

The latest release of *Office Works*, Version 2.0a, along with its gateways, serves organizations with few separate user groups reasonably well—especially those on a budget. Managers of systems that are more spread out, however, may find that added costs and administrative overhead work against the package.

Pricing for *OfficeWorks* starts with a \$495 six-user license, rises to \$895 for twenty and \$1,395 for fifty, and tops out at an economical \$1,995 for unlimited users. E-mail between one collection of users accessing the same copy of *Office Works*—Data Access defines this as a domain—and another group sharing a second copy requires gateway services provided by the

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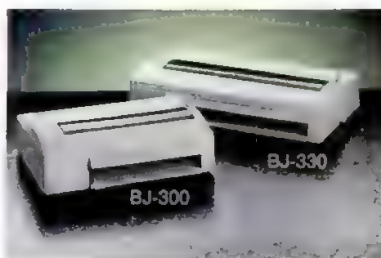
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CIRCLE 187 ON READER SERVICE CARD

\$695 Communications Option. The company also offers the \$695 *Office Works MHS Gateway*, which runs in conjunction with the *Communications Option*. Single-user counterparts of all modules cost \$195 apiece, or \$495 bundled.

The software's components weigh lightly on the price scale but combine in a way that easily tips the balance as network complexity or throughput requirements increase. Unlike many competing entries,

the standard package lacks any ability to exchange messages between two *Office Works* copies on the same LAN or bridged LANs. Both ends must first add workstations running copies of *Communications Option*, purchased separately. Additionally, each gateway must run a unique *Communications Option* copy even if all serve the same local domain. Likewise, multiple

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Office Works Communications Option, Version 2.0a

Office Works MHS Gateway

Data Access Corp., 14000 SW 119 Ave., Miami, FL 33186; 800-451-3539, 305-238-0012.

List Price: *Office Works Communications Option* for unlimited users, \$695. *Office Works MHS Gateway* for unlimited users, \$695. *Office Works*: 6-user version, \$495; 20-user version, \$895; 50-user version, \$1,395; unlimited-user version, \$1,995.

Requires: 640K RAM, DOS 3.1 or later, *Office Works* (*Office Works MHS Gateway* requires *Office Works Communications Option*). For proprietary gateway: *NetWare* or *NetBIOS* operating system. For MHS gateway: *NetWare* operating system.

In Short: Although its initial price is more than reasonable, increasing LAN complexity can quickly raise your *Office Works* expenditures. For example, each gateway must run a unique *Communications Option* copy even if all serve the same local domain; multiple domains on the same LAN also require individual copies of the *Communications Option*. With the inability to synchronize the address book between separate sites, this makes an *Office Works* installation better suited—from the standpoint of gateway setup and maintenance—to organizations with few e-mail domains.

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domains, although on the same LAN, require individual copies of *Communications Option*. The MHS module makes equivalent demands.

IRRITATING INSTALLATION

Office Works runs on *NetWare* and *NetBIOS*-compatible networks. The installation routine works adequately but provides a host of minor irritations, a characteristic that also infects competing entries such as *WordPerfect Office LAN*. For example, instead of guiding you with prompts when it needs the name of a program storage directory, the procedure demands DOS command line parameters—some with drive letters and colons, some without—functions a modern installation routine can and should provide.

Not surprisingly, gateway installations, both proprietary and MHS, as well as *Office Works* upgrades, follow a similar pattern, forcing you to recall the exact parameters you originally used to install *Office Works*, possibly long ago.

Default profiles for a number of standard gateway types come with the package, simplifying the setup process. In gen-

eral, configuring *Office Works*, *Communications Option*, and the MHS interface demands no furrowed-brow analysis, but the steps often bounce inconsistently between menus and unintuitive function-key selections. The manuals help, but hop considerably themselves.

INTEROPERATING MODULES

Besides providing mail exchange between domains on the same or bridged LANs, *Communications Option* can transmit to unattached domains—those located on separate, unbridged LANs—and receive from them. Behind the scenes, a mail database in the *Office Works* directory (which also contains *Communications Option*)

.....

In general, configuring *Communications Option* and the MHS interface demands no furrowed-brow analysis, but the steps often bounce between menus and unintuitive function-key selections

.....

stores messages created by users or awaiting receipt. A messenger program, a *Communications Option* module, shuttles mail between this holding pen and a queue.

The queues, one for every reachable domain, hold correspondence destined for a remote site or received from it by way of another *Communications Option* component called the interface. Transmission of all messages—both for MHS and the proprietary gateway—occurs when one or more exceed a priority level or age limit set by the administrator.

Administrators can configure the messenger and interface to execute in endless rotation, loop a fixed number of times before stopping, or run on individual computers. Executing the two programs on separate workstations, rather than making

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them share one in sequence, boosts throughput. If needed, the MHS module joins the program cycle.

SYSTEM MANAGEMENT AND EXTRA FEATURES

Office Works contains several features that ease gateway management. A supervisor may create equivalent and subordinate ad-

ministrators, for example, and the product can generate entries for remote users by importing comma-delimited data.

Communications Option also enables monitoring of phone usage and generates an adequate but not spectacular communications record. Known as the queue log, it tracks when messages hit the queue, their source and destination domains, number of enclosures, mail priority level, and return receipt information.

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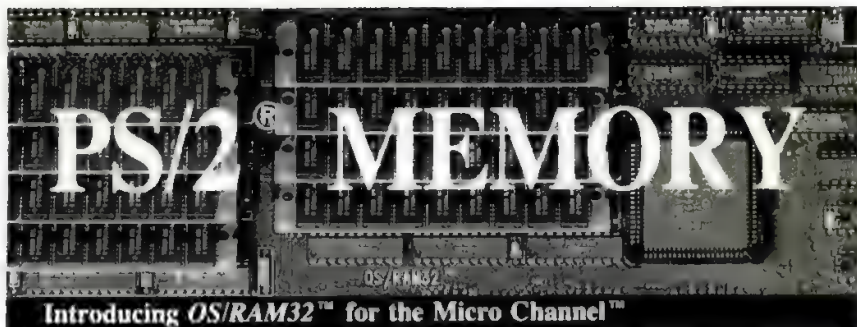
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Don't plan your retirement just yet; *Communications Option* leaves plenty of manual gateway administration to keep you busy. The lack of any automatic address-book duplication across an enterprise means that you may spend time replicating user changes by hand on separate domains. You'll want good backups, since users must have full rights to the program directory, which invites administrative disasters such as erased mail databases.

Programs supplied with the basic package let users pass a phone number and file for an outgoing fax to any of several Hayes fax boards. Similarly, the product can send files to EasyLink, AT&T's async-to-Telex service, via modem—if you provide the EasyLink-compatible comm software.

The company's competent technical support staff provides unlimited free, but not toll-free, phone support to system administrators, weekdays from 9:00 to 5:30 E.S.T. You can also reach them on CompuServe by typing GO CIS:DACCESS.

The software is straightforward if uneven. Getting the hang of gateway set-up and maintenance takes more effort than it should, but in configurations with few domains, the cost of *Office Works* and its modules helps offset the extra work.

WORDPERFECT CORP.

WordPerfect
Connections

WordPerfect
Connections MHS
Gateway

by M. David Stone

.....

WordPerfect Corp. is best known for its word processor, so it's not surprising that its workgroup software, *Office LAN*, has a similar look and feel. In particular, you will find that it provides a *WordPerfect*-like command structure for users and administrators in everything from the text editor to the *WordPerfect Connections* gateway modules. If you are a *WordPerfect* fan, you will feel right at home.

The base program in *WordPerfect's* e-mail system, *Office LAN*, costs \$495 for each 5-user license or \$1,495 for a 20-user license. To send mail to the rest of the world, you'll need *WordPerfect Connections*, \$495 per domain. *WordPerfect Connections* consists of a proprietary

CONNECTIVITY

E-MAIL LAN LINKS

asynchronous gateway and a program called *Connection Server*. *WordPerfect* also offers the *WordPerfect Connections MHS Gateway*, which we also reviewed, plus gateways for MCI and EasyLink. Each costs \$495 per installation, which usually translates to a reasonable \$495 per LAN. All three require the *Connection Server* program in the *WordPerfect Connections* package.

WordPerfect also expects to offer a limited fax capability by the time this review is published. A full-fledged fax gateway, an X.400 gateway, and a standalone remote module are under development.

The underlying structure for the e-mail system is straightforward. *Office LAN* includes e-mail as one module in a larger package. For each copy of *Office LAN* that you install, the e-mail module is an independent host post office.

The *Office LAN* program, its administration modules, and the e-mail directory structure all install on a file server, and *WordPerfect* suggests setting up at least one host post office per file server on your LAN. But *Office LAN* itself does not provide any way for hosts to communicate with each other. For that, you need the *Connection Server* program found in *WordPerfect Connections*.

SERVER SETUP ALTERNATIVES

Each copy of the *Connection Server* can link a group of hosts into a domain, exchange mail with a gateway, and exchange mail with other domains on the same LAN. The program runs on a workstation, regularly polling each host and gateway (proprietary, MHS, or otherwise) that it knows about. As administrator, you can set how often polling takes place; the default as shipped is every ten seconds.

To avoid delays in moving mail, you will want the *Connection Server* running all the time. If you have more than one host and no gateway, you will want to dedicate one workstation solely to the task of running the *Connection Server*. With the asynchronous proprietary gateway, you can optionally install the gateway as a TSR, which is how we used it, and employ a single workstation as both connection server and gateway.

You can also use a single workstation to rotate among *Connection Servers* for different domains, and rotate EasyLink, MCI, and MHS gateways with a batch file. Of course, the more traffic you have on the

system, the less easily you can get away with nondedicated machines.

In any case, the Connection Server, as well as both the proprietary and MHS gateways, can run on an 8088-based PC, although WordPerfect recommends a 12-MHz 286 or better. *Office LAN* and the proprietary gateway will run on *LAN Manager*, *NetWare*, *VINES*, and *NetBIOS* networks; the MHS gateway is limited to use on *NetWare*. A Macintosh version of *Office LAN* for AppleTalk is currently under development.

According to WordPerfect, the proprietary gateway supports all e-mail features available on a single LAN, including resource scheduling and multiple attachments. One nice touch is a pass-through feature that lets you retain *Office*-specific features between two *Office LAN* LANs, even when sending mail through EasyLink, MCI, or MHS. This can be useful when communicating through EasyLink or MCI as a way to minimize long-distance phone expenses, for example. Similarly, it lets you set up a centralized MHS hub for communications among widespread branch offices, not all of which are standardized on *Office LAN*.



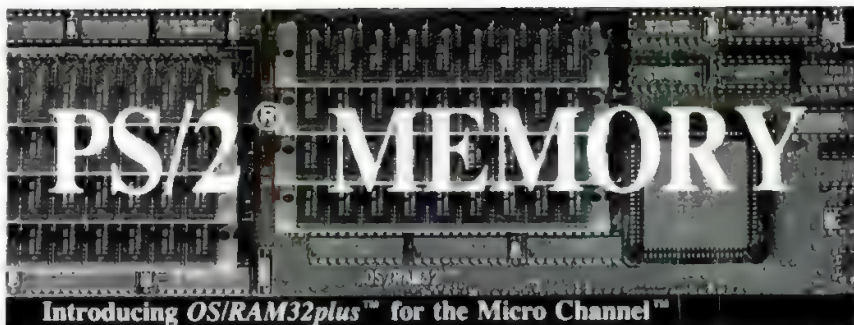
WordPerfect Connections, Version 1.0
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List Price: WordPerfect Connections, \$495 per domain. WordPerfect Connections MHS Gateway, \$495 per installation. *Office LAN*: 5-user license, \$495, 20-user license, \$1,495.

Requires: 640K RAM, DOS 3.0 or later (WordPerfect Connections MHS Gateway requires WordPerfect Connections). For proprietary gateway: NetWare or NetBIOS operating system. For MHS gateway: NetWare operating system.

In Short: WordPerfect Connections' setup and administration features use the same arbitrary function-key commands as the company's word processor—a boon for WordPerfect users, but not for others. Like the word processor, Connections is occasionally cumbersome to use. In particular, automatic directory propagation is oddly missing from this otherwise full-featured program. One plus is a pass-through feature that lets you retain features between two *Office LAN* networks when sending mail via WordPerfect Connections MHS Gateway.

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You control access to all administrative functions by assigning network rights. *Office LAN* normally encrypts all messages, but users can choose not to encrypt a given message. The administrator cannot turn off encryption. Encryption is available over the proprietary gateway, but not over the MHS gateway.

Unfortunately, the e-mail system's underlying simplicity does not carry through to setup or maintenance. One problem is that as with most e-mail packages we reviewed, the administration manuals often give unclear instructions. Moreover, *Office LAN* and WordPerfect Connections require cumbersome extra steps that you will not find in other programs. Every time you change information about the system, you have to generate new *Office LAN* files for each domain, a procedure equivalent to compiling a program before you can run it.

Most troublesome is the absence of automatic directory propagation. Whenever you add, delete, or modify a user entry, you have to change the entry manually in each domain. There is no script language to help automate these tasks. WordPerfect says it will add directory propagation in a future upgrade of Connection Server but is not saying when.

TRAPPED BY ITS OWN SUCCESS

WordPerfect is also trapped by its own success. By following the same command structure in *Office LAN* as in its best-selling word processor, the company keeps faith with its users. But for anyone else, the arbitrary function-key commands will be anything but intuitive. Even the help system uses the WordPerfect F3 for help, instead of the nearly universal F1.

Technical support for e-mail administration is essentially identical to what WordPerfect users are used to. There's a toll-free line available from 8:00 to 5:00 M.S.T. and a toll line after hours. The gateway itself has a separate help line, but it's not toll-free.

Office LAN and WordPerfect Connections are fundamentally much like WordPerfect: long on features but short on straightforward ease of use. Ultimately, the packages' greatest strengths are their greatest weaknesses. If you're comfortable with the WordPerfect word processing package, you will be comfortable with *Office LAN* and the gateways available via WordPerfect Connections. If not, you're likely to find setup and administration more cumbersome with them than with some of their competitors.

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(Delrina) WINFAX PRO is a state-of-the-art Windows send and receive fax system for your PC. Send quality faxes from any Windows application to a fax machine or another PC. Sends and receives faxes in the background. Schedule faxes and merge ASCII files into the phone book. Requires Windows 3.0 and a compatible fax modem. **FX0154 \$75.**



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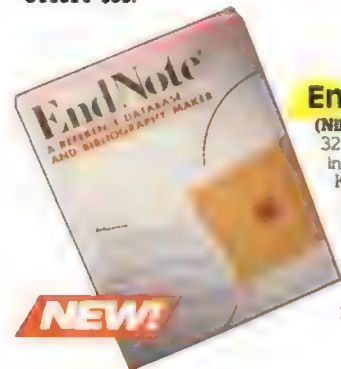
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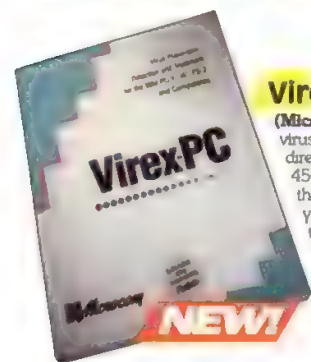
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UT1684 ★ Becker Tools 2.0 76.

Artworx

BS4093/5 Graftex 85.
BS0773/5 dBASE IV 1.1 485.

Ashton Tate

BS0773/5 dBASE IV 1.1 485.

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GR0804 Label Pro Laser 49.

Bloc Publishing

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BS2014 PC File 5.01 99.

Campbell Services, Inc.

BS3584 ★ OnTime for Windows 75.

Career Design Software

BS4034 Career Design 65.

Central Point Software

UT2064 Central Point Anti-Virus 79.
UT2133 PC Tools 7.0 109.

Chronologic Corp.

UT0584 Instant Recall 62.

Chronos

BS2184 Who What When 2.0 169.

Computer Easy International, Inc.

UT2063/5 Command Performance 39.

Contact Software Int'l

BS1064 ACT! 2.0 215.

BS3514

5-User Network Version 799.

BS3504

Network Server Plus One 355.

DacEasy Inc.

FN0014 Dac Easy Accounting 4.1 85.
FN0024 Dac Easy Bonus Pak 4.1 129.

Dariana Technology

UT1894 System Sleuth Analyzer 45.
UT1904 System Sleuth Pro 3.0 63.
UT1704 ★ Win Sleuth 1.0 85.

Datasmart Tech.

CM0424 Procomm Plus 2.0 65.

DCA/Crosstalk Communications

CM0193/5 ★ Crosstalk for Windows 1.1 129.

Delrina Technology

BS0853/5 PerFORM Designer & Filler 2.1 95.
BS2604 ★ PerFORM PRO 149.
FX0154 WinFax Pro 75.

ElaShim Microcomputers, Inc.

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UT2024 FastTrax 4.0 49.

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BS3574 Strategic Planning Plug-In Module 65.

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UT0724 Direct Access 5.1 62.
UT0124 Fastback Plus 2.10 115.

Formworx Corp.

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BS4065 FoxPro 2.0 499.

Funk Software

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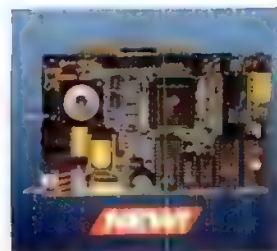
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UT1874	XTree Gold 2.0	92

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LN0043/5	QuickC 2.5	65
Nantucket		
LN1444	Clipper 5.1	510
Solution Systems		
LN0433/5	Brief 3.1 for DOS	179
Spinnaker Software		
LN1464	★ Spinnaker Plus	269

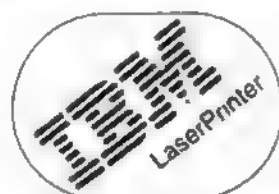
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LINKING LANs

.....
Connecting LANs can be tricky. Here's a guide to the various alternatives, an explanation of the jargon, and a look at the costs.

The Media Move The Message

BY FRANK J. DERFLER, JR., AND KIMBERLY J. MAXWELL Nobody ever said that LAN-to-LAN connectivity is easy. Not only do you have to decide about the devices you will use to control the flow of data between LANs, but you also have to consider the transport media. Finding, selecting, buying, and installing the communications links between the LAN segments is often a challenging proposition.

Many options are available, each with unique capabilities, complications, and costs. Internetwork

media run the gamut from telephone lines and satellite networks to microwave radio, fiber-optic networks, and even cable television coaxial systems. This list also includes public data networks, always popular in Europe and increasingly so in the U.S.; we cover this expanding and important technology in "Reliable Relays."

You might even question the need for special links between LAN segments. Why not just plug in a couple of modems, dial up one LAN segment's modem from the other, and let them talk? The answer: You

can dial up a connection and in some cases you should. But when the data load is heavy and the call long, the cost of this kind of service will be high and the efficiency low. That's why there are special services to meet special needs.

LONG-DISTANCE DILEMMAS

Typically, the noise and degraded signals important in longer-distance communications links mean that data moves more slowly. As the pulses of electricity or light

representing data bits travel long distances through copper or fiber-optic cables, they lose their sharpness and strength. And as copper cables travel over longer distances, they accumulate electrical noise. Unfortunately, because the signals needed to represent the 0s and 1s on a fast communications circuit are closely spaced, the communications equipment at either end of the circuit cannot tolerate signal degradation or noise in the data stream.

Despite these problems, modern techniques allow the transmission of data at high speed over long distances. Multi-

GLOSSARY: Linking LANs

by Frank J. Derfler, Jr.

■ Basic Rate Interface (BRI)

The ISDN standard governing how a customer's desktop terminals and telephones can connect to the ISDN switch. It specifies two B channels that allow simultaneous 64-kilobit-per-second voice and data service, and one D channel that carries call information and customer data at 16 Kbps.

■ B channel

The "bearer" channel of an ISDN interface. It carries voice or data in either direction at 64 kilobits per second.

■ bypass

A connection established with an interexchange carrier without going through a local exchange carrier.

■ D channel

The "data" channel of an ISDN interface, used to carry control signals and customer call data in a packet-switched mode. In the BRI, the D channel operates at 16 kilobits per second.

■ delay

Commonly, a pause in activity. Delay can also be a kind of distortion on a communications circuit. Delay is the property of an electrical circuit that slows down and distorts high-frequency signals. Devices called equalizers slow down the lower frequencies and "equalize" the signal.

■ direct distance dialing (DDD)

Use of the common long-distance telephone system.

■ distortion

Any change to the transmitted signal. Distortion may be caused by cross talk, delay, attenuation, or a number of other factors.

■ Distributed Queue Dual Bus (DQDB)

A proposed MAN standard. See *metropolitan area network*.

■ Fiber Distributed Data Interface (FDDI)

A specification for fiber-optic networks operating at a speed of 100 megabits per second.

■ fractional T1

A subset of the T1 channel. Interexchange carriers commonly sell fractional T1 service at rates of 384, 512, and 768 kilobits per second.

■ interexchange carrier (IXC)

A class of telephone companies that provides long-distance communications between local telephone companies.

■ leased line

A communications circuit reserved for the permanent use of a customer. It is also called a *private line*.

■ local exchange carrier (LEC)

The local telephone company, operating as a monopoly under the control of the FCC and public utility commissions.

■ local loop

The connection between the customer's premises and the local exchange carrier's central office.

■ metropolitan area network (MAN)

A public high-speed network (100 megabits per second or more) capable of voice and data transmission over a range of 25 to 50 miles (about 40 to 80 kilometers).

■ point of presence (PoP)

The termination point of service from an IXC. The LEC connects between your premise and the PoP through the local loop. Optionally, you can connect to the PoP over circuits that bypass the LEC.

■ T1

A 1.544-megabit-per-second communications circuit that can be used for digitized voice or data transmission. T1 lines are typically divided into 24 64-kilobit channels.

■ T3

A 44.736-megabit-per-second service that provides 28 T1 channels. Capable of handling 672 voice conversations, T3 service is typically delivered over fiber-optic cable.

■ very small aperture terminal (VSAT)

A relatively small satellite terminal for digital communications, 1 to 3 meters in size.

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HXM	4 2 Ser., 2 Par.	Any Combination	256KB - 16MB	Pop-up or Buttons	\$295 / 256KB \$395 / 1MB
HXS	4 Serial	Any Combination	256KB - 16MB	Pop-up or Buttons	\$295 / 256KB \$395 / 1MB
HWP	5 Parallel	3/2 4/1	256KB - 16MB	Pop-up or Buttons	\$295 / 256KB \$395 / 1MB
HXP	4 Parallel	2/2 3/1	256KB - 16MB	Pop-up or Buttons	\$245 / 256KB \$345 / 1MB
HCP	2 Parallel	1/1	256KB - 16MB	One Printer	\$225 / 256KB \$325 / 1MB
AS-41	5 Parallel	4/1	None	One Printer	\$195
AS-31	4 Parallel	3/1	None	One Printer	\$175

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plexers, repeaters, and other special equipment help offset the problems. But the equipment is expensive, and the combination of signaling speed and distance increases costs. While you can buy and install your own cable to run data at 10 megabits per second for less than \$1 per foot at distances of several thousand feet, you'll have to pay about \$15,000 per year to lease a 1.544-Mbps telephone-line link from New York to San Francisco. You may need to spend several thousand dollars more up front for the equipment for an interface between your computers and the leased line.

In all of the decisions you make regarding linked LANs, you will have to balance throughput against distance and cost (see the sidebar "Decision Guide: Selecting LAN-to-LAN Transport Media" to help put these issues in perspective). Because the cost of the internetwork segment is typically the driving factor in the equation, you are usually better off putting a significant investment into network hardware that makes the best use of the long-distance media. (For more information about internetwork hardware options that provide the data compression and discrimination features that will save you money on the Internet, see "Smart Links Between LAN Segments" in this issue.)

DIAL-UP VS. LEASED LINES

Perhaps the most common of the long-distance media options are telephone lines. Telephone systems in every country offer two types of connection services: *dial-up lines* and *leased lines*. When you dial a number, you program a series of computerized telephone switches that create a temporary circuit between two points; this dial-up connection lasts until either party hangs up. The second service, called a leased line, is a permanently connected line that offers a full-time dedicated connection between two points.

In a technical market like telecommunications, companies strive to differentiate their products and make maximum use of their resources. Long-distance carriers such as AT&T, MCI, U.S. Sprint, and others, resell their switched-line services in ways that make them appear to be full-time dedicated lines. These *virtual private networks*, or VPNs, offer the subscriber services equivalent to full-time leased lines, at a lower cost. With VPNs, the computerized telephone switch is programmed with information about the

connection you want to make. When your modem goes "off hook" on the telephone line, the switch automatically makes the connection to the destination. A VPN also has advantages for the long-distance carriers. It allows them to make optimal use of their switched-line systems, essentially by selling the same line many times over.

It's important not to overlook ordinary dial-up lines for use in basic LAN-to-LAN connectivity. By using a modem that complies with the CCITT V.32bis standard for signaling and the V.42/V.42bis standards for error correction and data compression, you can transfer e-mail

.
**Perhaps the most
 common of the long-
 distance media options
 are telephone lines.**

messages and similar compressible files over dial-up telephone lines with an effective throughput of 50 kilobytes per second (Kbps) or greater.

The deciding factor between dial-up service and leased lines is cost. You pay for a dial-up circuit by time used, usually in intervals of 6 to 30 seconds. You lease dial-up circuits on a monthly or annual basis. The pricing of dial-up lines is time- and distance-sensitive: Companies charge according to how long you hold up the circuit and the distance between the connected points.

Leased lines have distance-sensitive pricing, so cost comparisons with dial-up lines are difficult. A formula for determining the cost of a leased line is:

cost = base monthly rate + (monthly charge per mile x number of miles).

A good rule of thumb: If your organization makes daily dial-up connections lasting 3 hours or more, you should consider a leased line.

You should also know about *Switched 56*, an important service for LAN-to-LAN connectivity. Offered by both local and long-distance companies, it provides signaling at 56 Kbps over dial-up lines. When

you order Switched 56 service, the local telephone company terminates the specified telephone line from your building with a special device called a data line card that is installed in their switching equipment. You must buy an interface device for the end of the circuit in your office that can communicate with that data line card. Telephone companies sell this device under several different names, but they often call it a Meridian Data Unit, the name given it by the original manufacturer, Northern Telecom. Prices vary, but the device costs \$600 to \$800, less than many high-speed modems.

Switched 56 service is quickly becoming available throughout the U.S. In the last year, some companies dropped the rates for Switched 56 service to nearly the same rate they charge for regular long-distance voice calls. Switched 56 offers tremendous potential for LAN-to-LAN connectivity, particularly when you don't need full-time connections between LANs.

GOOD COORDINATION REQUIRED

Leasing telephone lines in the U.S. became complicated in the last decade, thanks to the Federal Communications Commission's 1980 Computer Inquiry II decision and the Federal Court's Modified Final Judgement (which continues to be modified and is never final), which broke apart the Bell system. These rulings imposed guidelines on what services the fractured companies in the telephone industry could provide. While the *local exchange carriers*, or LECs, that provide local telephone service remain monopolies, competition thrives among the long-distance companies, known as *interexchange carriers*, or IXC's (see the sidebar "You Can Get There From Here: Elements of a Long-Distance Link"). Local exchange carriers sell the basic service between homes and buildings in a particular city or community, while the interexchange carriers provide the links between the local exchange carriers.

At least eight IXC's provide nationwide service in the U.S. and many more cover specific geographical areas. The LECs operate in monopoly areas under the regulation of the FCC and local public utility commissions.

The FCC regulates AT&T's price schedules, or tariffs. Other carriers, such as MCI and U.S. Sprint, are not obligated to file a schedule of public tariffs, but they do in order to compete with AT&T's published tariff rates.

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DECISION GUIDE: SELECTING LAN-TO-LAN TRANSPORT MEDIA

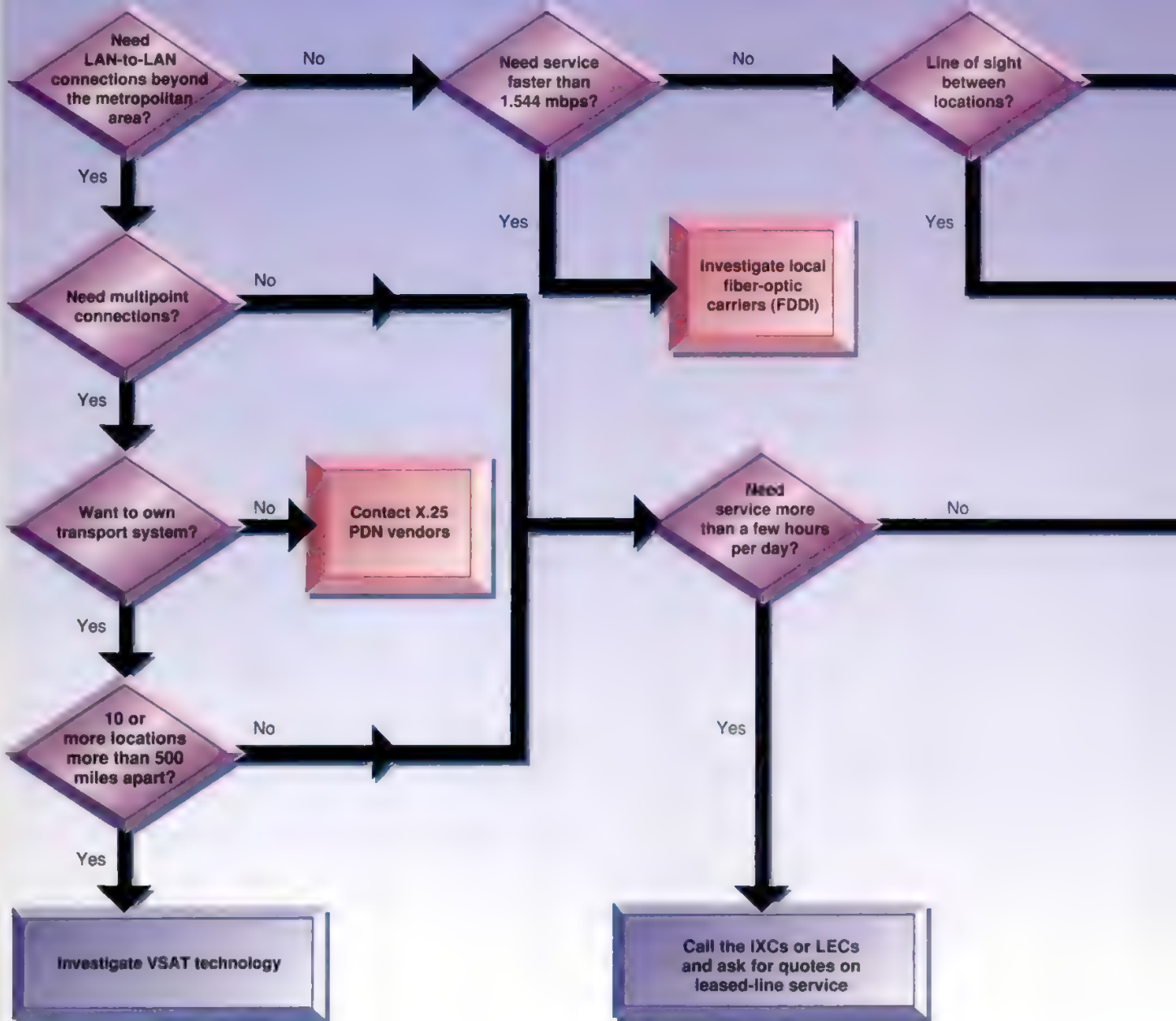
This chart is designed to help you decide which category of connection alternatives will best meet your LAN-to-LAN communications needs. As you can see on the chart, if you need to connect LANs that are within the line of sight of each other, you can set up your own wideband microwave radio system. While the initial hardware cost can be high, you can get the

throughput speed of a T1 connection without its associated monthly fees. Of course, this solution is good only for very specific situations.

If you need to connect LANs in a metropolitan area that do not have a line of sight between each other, but you do not need speed greater than 1.544 megabits per second, a leased line from your local carrier should do fine. You can also look into ISDN.

FDDI is a good solution when the logistics are the same but speed is more important.

Moving beyond the metropolitan area, users who need to make connections between two LANs for more than a few hours a day are better served by leased-line services than dial-up lines. And for organizations with multiple locations great distances from one another, VSAT



CONNECTIVITY LINKING LANs

technology is the optimum solution.

Users who are more comfortable leasing transport systems will want to investigate X.25 PDNs (see "Reliable Relays" in this issue). These services particularly serve the needs of users with three or more locations, but they can be a good choice for companies with even fewer locations who need the protection and reliability X.25 affords.

No

Use leased lines from the local exchange carrier or investigate ISDN

Consider your own wideband microwave radio link

Consider using dial-up lines

The different and tightly regulated roles of IXC and LECs confuse the processes of ordering and managing circuits. For example, if you want a leased line from Chicago to San Francisco, you can place the order with the local carrier in Chicago (Ameritech), with the local carrier in San Francisco (Pacific Telesis), or more typically, with any of the long-distance carriers. In all cases, the carrier receiving the order must coordinate with the other two carriers to install the service. This coordination sometimes goes smoothly, sometimes poorly. You could also ask the company installing termination equipment to place the order, or trust a consultant, or place three separate orders yourself.

But no matter how you order the circuit, be prepared for finger-pointing when you have problems with the circuit, for billing problems when you don't. The breakup of the Bell system diluted responsibility and brought a rat's nest of billing problems to the leasing of U.S. telephone lines.

One way to avoid the finger-pointing and billing problems is to use a technique called bypass. Bypass involves going around the local exchange carrier and setting up your own private connection to the nearest service point of the interexchange carrier. Sometimes this can be as simple as installing your own \$20,000 microwave link over a path a few blocks long. In other situations, it's a very expensive alternative. That's especially true when the service point of the interexchange carrier is far away from your facility and you need high-speed connections.

Over 6,000 U.S. communications consultants deal in setting up the most reliable and efficient telephone service available for companies. It's not a simple task. These consultants shop the different leased-line vendors for the best price and best solution for their clients. If you are shopping on your own and want industry-standard performance statistics to help you make a decision, check with the major carriers first. They can give you quotes on reliability measures like error-free seconds and uptime, and they will supply information on the availability of their leased, private-line service.

Other countries typically have a state-controlled telephone-system monopoly that offers users a complete long-distance service package from one source. While one-stop shopping is an advantage, it is

not unusual in many of these countries to pay the equivalent of thousands of dollars for the installation of a dial-access line or to wait months for leased-line service.

T1 AND T3 LINKS

Leased lines for digital data transmission are available in various grades of service. The grade of service relates to the level of distortion, noise, delay, and other factors that degrade high-speed data. Leased data lines are specially configured or conditioned for data transmission in several speed ranges.

Leased lines range in speed from 2.5 kilobits per second to 45 megabits per second. The standard measure of digital leased-line service is referred to as the *T1 channel*. The T1 channel is a circuit with a transmission rate of 1.544 Mbps that meets certain standards and characteristics for circuit termination and signaling. Although you would normally use a T1 channel for long-distance connections, you can arrange for one to be set up between two or more buildings in a campus or between different offices in one building.

With monthly rates ranging from about \$10,000 for a dedicated T1 connection across a 1,000-mile area to approximately \$6,000 for the same line covering 500 miles, the T1 alternative is appropriate mostly for organizations with a need to move a lot of data.

For an organization looking for even faster connections, a *T3 link* can transfer data at a rate of 45 Mbps. Like the T1 link, this alternative is expensive, costing approximately \$100,000 per month for a 1,000-mile connection.

As a subscriber, you have to pay not only the price of the T1 or T3 link, but an additional monthly fee for the LEC connection and the termination equipment that interfaces the circuit with computers at the end location.

Nevertheless, T1 service provides excellent flexibility in organizations with a variety of voice and data requirements. For example, one channel used solely for digitized voice typically requires about 64 kilobits per second. With the proper equipment (generally, a specialized multiplexer), you can compress it to a channel of 32 or even 16 Kbps. Thus, you could use 768 Kbps of the T1's 1.544-Mbps capacity to provide 12 voice lines between your organization's PBXs and still have another 776 Kbps for use with routers, bridges, or other tools for LAN-to-LAN connections.

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YOU CAN GET THERE FROM HERE: ELEMENTS OF A LONG-DISTANCE LINK

The creation of long-distance links over leased lines can be a complicated business, requiring the cooperation of different carriers and various products. The diagram below illustrates the various pieces typically involved in the process, from bridge or router to local exchange carrier to interexchange carrier, using the common T1 circuit.

When you connect a remote bridge or router to a high-speed T1 or fractional T1 communications channel, an adapter board in the bridge or router changes the network traffic into a stream of data that meets one of several standards for connection and signaling. The output might follow the EIA (Electronic Industries Association) RS-232 or RS-449 standards, or the CCITT (International Telegraph and Telephone Consultative Committee) V.35 standards. You need to connect that output to a multiplexer, a device that interfaces with the high-speed communications line.

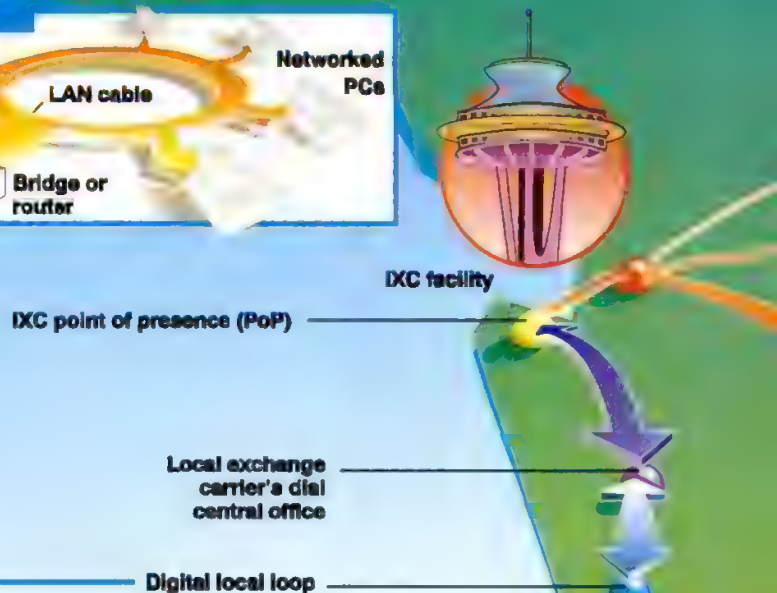
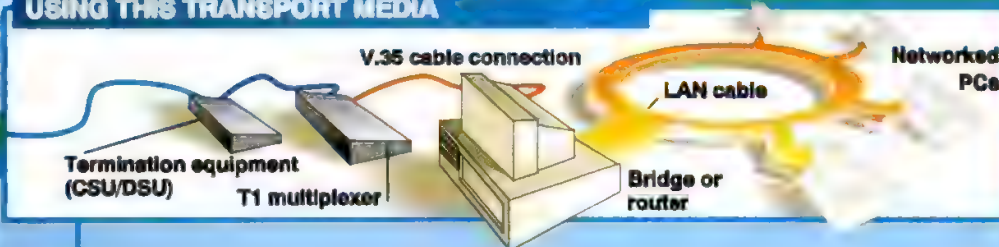
The multiplexer subdivides the single

available fast communications channel into multiple channels of voice and slower data communications. Companies such as Network Equipment Technologies, NewBridge Networks, StrataCom, Timeplex, and Verilink Corp. provide multiplexer equipment.

The cost of typical multiplexer equipment starts at about \$2,500; it climbs to many times that amount for sophisticated multiplexers with network management and reporting functions.

Other equipment used in data links include a channel service unit (CSU) and a data service unit (DSU). The CSU is the

EQUIPMENT TYPICALLY LOCATED IN OFFICES USING THIS TRANSPORT MEDIA



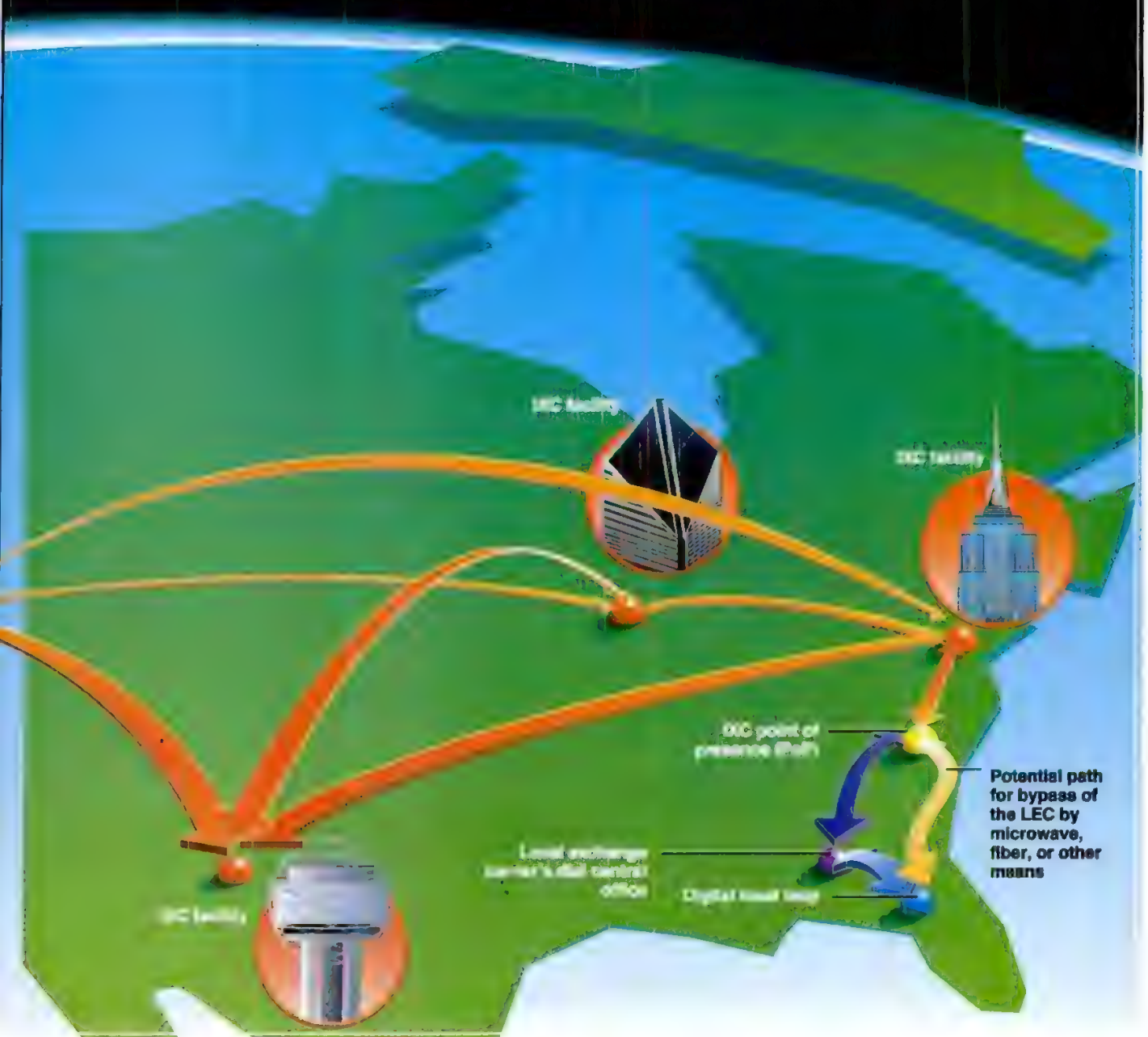
CONNECTIVITY

LINKING LANs

side of the equipment connected to the communications channel, while the DSU can be connected to the bridge or router. The CSU terminates the high-speed circuit and keeps the signals in phase and properly timed. A DSU converts all the incoming data into the proper format for transmission over the T1 or fractional T1 circuit. Some bridge products contain a DSU, so all you need is a CSU. Some companies sell combination CSU/DSU products for as little as \$500.

The local exchange carrier (LEC) typically provides a digital line, extending service between the premise and the interexchange carrier's (IXC) point of presence (PoP) through the dial central office.

The IXC passes the data through its high-speed network to a similar installation provided by a different LEC at the other end. Alternatively, some organizations might choose to bypass the LEC and provide their own circuits to the interexchange carrier's PoP.



IXCs commonly sell fractional T1 service at rates of 384, 512, and 768 Kbps. A 1,000-mile 512-Kbps service costs about \$7,000 per month, plus the fees for terminating circuits and equipment.

Years of testing at PC Magazine LAN Labs have shown that a typical PC with a 10-MHz 80286 processor running an average local area network, such as Novell's *NetWare 2.x*, offers users throughput of approximately 750 Kbps. Even a fractional T1 line can give users this kind of LAN-like response time over a long-distance link.

Many experienced network users and administrators are familiar with the problems associated with leased-line failure. When an organization relies on leased lines for production and the conduct of business, any amount of downtime can spell catastrophe. One solution is to use separate leased-line circuits from different carriers. If you've bought redundant services, your bridge or router can choose a line that is currently up and available. Some routers offer a backup service for your leased line through a standard dial-up connection. But again, the question of cost comes into play when contemplating any solutions for possible downtime.

SATELLITES: HIGH ALTITUDE COMMUNICATIONS

Instead of leasing long-distance circuits from telephone carriers, many organizations use their own private satellite radio systems to carry data between widely separated enterprises.

Offering services including on-call emergency backup, point-to-point data rates of 19.2 Kbps, and speeds comparable to multiple T1s, companies such as Alascom, AT&T Tridom, Comsat General Corp., GTE Spacenet Corp., and others, sell satellite communications solutions to private industry and government.

Communications satellites move in a geosynchronous orbit about 23,300 miles above the equator. From this position, individual satellites can receive and relay data to large segments of the earth.

This orbital vantage point gives communications satellites an advantage over land-based leased-line systems. Satellite connections are safe from problems that plague connections on terrestrial circuitry, such as disruption by accident or natural disaster. Interexchange carriers often use satellites to back up their own copper- and fiber optics-based systems.

Satellite circuits generally do not sell with distance-sensitive pricing. Companies providing these services charge for the time of connection and amount of information passing through their satellites' transponders. A rule of thumb: Satellite communications are usually cost-effective only if you use them for connections over a distance of 500 miles or more. But there's an exception for large systems; they can gain a scale of economy that makes it reasonable to use satellite communications for shorter links.

An important feature of satellite communications systems is their ease of in-

• • • • •

**Satellite connections
are safe from problems
that plague land-based
leased-line systems.**

• • • • •

stallation and independence from the standard telephone-line cabling system. Satellite systems providing LAN-to-LAN links can use *very small aperture terminals*, or VSATs, with antennae that measure approximately 1.2 to 2.8 meters in size (see the diagram "Satellite Communications: Long-Distance Links to Look Up To"). A VSAT antenna mounts on a rooftop, in a parking lot, or on a vehicle, allowing for almost complete mobility of your communications system. A simple cable runs from the satellite terminal to the office or building housing the LAN.

The least expensive VSATs normally provide a signaling speed of only 19.2 Kbps. That may be adequate for many applications, but it's not useful for transporting large amounts of data between LANs. To increase the signaling rate to T1 speeds, you must install a larger and more expensive antenna, typically 3 to 4 meters in diameter. The antenna size and circuit speed also depend on the geographical location of the station and the surrounding radio-frequency environment.

But no communications system is perfect. Satellite links have their drawbacks. The first is the need for bigger antennae if you want faster throughput. The second is

referred to as *satellite delay*.

The problem of satellite delay is a problem of basic physics. Because of the great distances between the antenna and the orbiting satellite, even at the speed of light (300 million miles per second) it takes 0.27 seconds for the signal to travel from the antenna to the satellite and back again. This delay is acceptable for intermittent updates of electronic mail, spreadsheets, and the like. But users expecting immediate replies to their individual keystrokes and commands will notice the long wait.

A typical monthly charge using Scientific-Atlanta's SkylinX.25 or SkylinX Express ranges from \$250 to \$600 per site. A competitor, Hughes Network Systems, offers LAN connectivity solutions that cost between \$380 and \$450 per month per site, including installation and maintenance fees. Some VSAT systems are economical only for large systems of 200 ground terminals, limiting these solutions to large organizations. But if your company has just a few ground terminals, it's possible to share a satellite network with other companies, making the charges more economical.

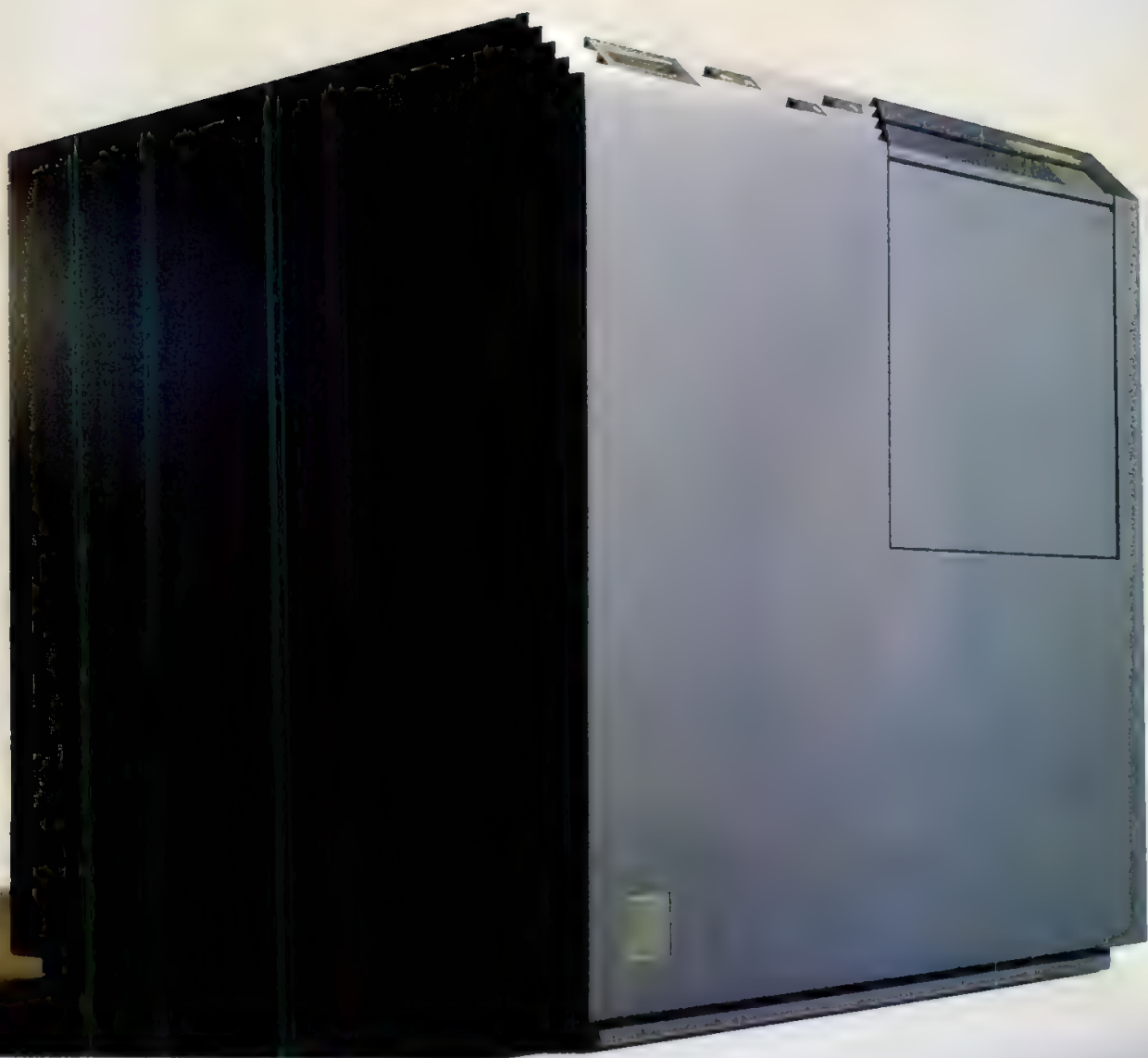
FDDI AS A METROPOLITAN CARRIER

Some LAN-to-LAN links do not have to traverse hundreds of miles. In many cases, organizations need only to link across a campus or city. The limited distances of *metropolitan area networks*, or MANs, allow faster communications. For planning purposes, you can think of a metropolitan area as a circle with a 100-kilometer, or 62-mile, circumference.

The IEEE 802.6 committee recently approved a standard protocol for MANs. The *Distributed Queue Dual Bus*, or DQDB, protocol includes a physical topology of two parallel cables linking each node of the system. The cabling will be fiber-optic and the nodes will typically include the use of a router to connect the LAN segments. This dual-cable topology offers users a reassuring level of reliability and the ability to operate at high speeds over the MAN. The signaling will be 100 Mbps, a speed capable of handling almost any application or data transfer. In the near future, local exchange carriers will probably offer MANs operating under the DQDB standard.

A service called *Fiber Distributed Data Interface*, or FDDI, is available now in several cities. FDDI networks are meant to operate at a speed of 100 Mbps, al-

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system looks like.



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ETMS,[™] Everex Thermal Management System, makes this the first system to solve the high temperature and related reliability problems of current and future processors. A partition separates the cube into two compartments, independently cooled by SmartFans.[™] One contains the CPU, one the drives. Baffles funnel cool air where it's most needed. Even the power supply is cool, because at 400 watts, it runs at a fraction of its capacity.

Removable motherboard for instant upgrades, which we'll bring you as new technologies emerge.

All the full-length expansion slots you'll ever need—12 altogether, including 10 EISA slots. The cube is also available in 8 slot ISA configurations.

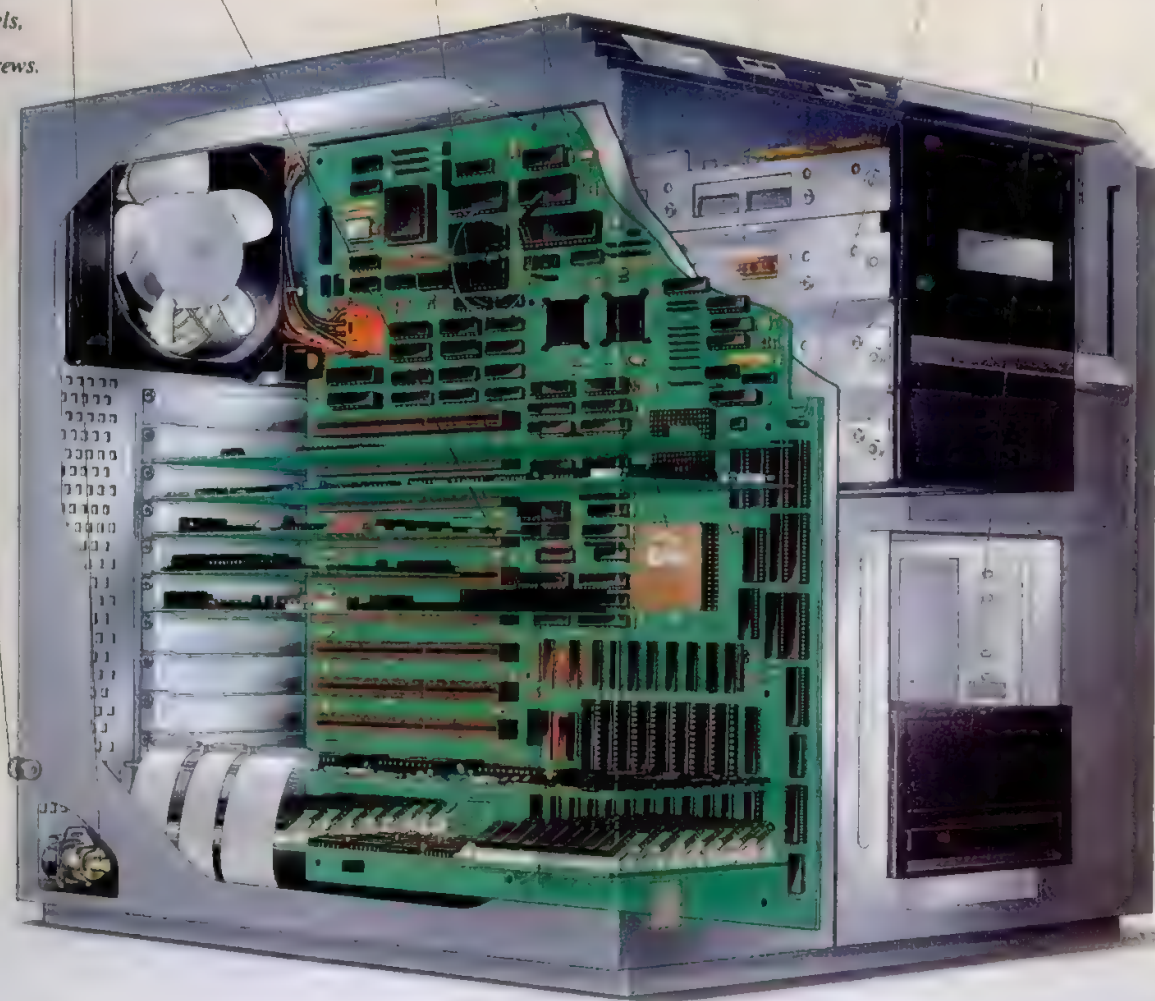
AMMA, a 256KB write-back caching architecture, forming "two-tier" caching in combination with the 486 chip's 8KB internal cache. It improves the cache hit ratio from 90% to as much as 99%.

Space for four quick release, half-height drives. They're front accessible, behind a hydraulically dampened door—which makes sure your drive heads are reading disks and tapes, not dust, smoke and humidity.

The 486/33 CPU chip, Intel's hottest. But when hotter chips come around, the cube will be cool enough to handle them. And that includes multiprocessors.

Quick release drive bays accommodate up to four more drives that can be swapped out in less than five minutes.

The entire interior of the cube is accessible in seconds through side panels, using thumbscrews.



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Conventional system design can't cope anymore. The emerging technology is just too hot for it.

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Combine all this with up to 64 MB of RAM—enough for the most demanding applications—and you wind up with a computer that can be configured for anything.

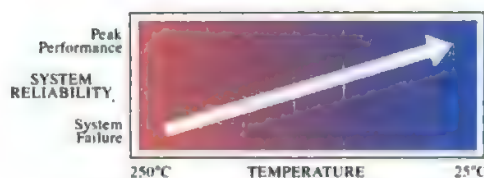
Even the future.

You see, the design breakthroughs of

the STEP Megacube eliminate the upgradability problems inherent in other systems. Which means that when the next generation processors arrive—like the 50MHz 486, just down the road—all you have to do is swap out motherboards. No space problems. No overheating problems.

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though design constraints limit maximum actual throughput to about 80 Mbps. FDDI networks also do not cover as large an area as DQDB MANs. They are limited to approximately 100 kilometers of cable in each section (DQDB should be able to work over greater distances) and the nodes must be within 2.5 kilometers of each other. Easily installed, in some cases using the cable system already in offices, FDDI networks can serve as the backbone of communications services available in the area. Eventually, FDDI networks will serve as a gathering point for traffic that will in turn be fed to the DQDB standard MANs.

The logical topology of the FDDI is based on a primary and secondary ring of fiber-optic cable. These rings connect in a physical hub topology similar to the IEEE 802.5 Token-Ring standard architecture. All the nodes must be attached to the

primary ring. Since the secondary ring typically serves as a backup for the primary ring and supplies fault isolation capabilities, economics might dictate that some nodes do not get attached to the secondary ring. The cable itself costs about \$1.25 to \$1.65 per foot, connectors can cost about \$10 each, and there is a lot of skilled labor involved.

Products like BICC Data Networks' ISOLAN FDDI/802.3 bridge or the Raycom 5600 Series FDDI System use FDDI to link LAN segments. These bridges attach to the primary and secondary rings of the FDDI to move data between the Ethernet LANs while providing full FDDI fault-isolation capabilities to the LAN segments. Because the FDDI inter-LAN segment offers a large data-carrying capacity of 80 Mbps, routers are

not necessary and you can install bridges instead, with much the same effectiveness. Unfortunately, currently available FDDI bridges are relatively expensive, making independence from expensive routers a catch-22. The ISOLAN FDDI/802.3 bridge, for example, costs over \$22,000.

Even those companies known for their leased-line market sell FDDI products. For example, AT&T's StarWAN product line includes everything from LAN hardware interfaces to multibridges specifically designed for FDDI networks.

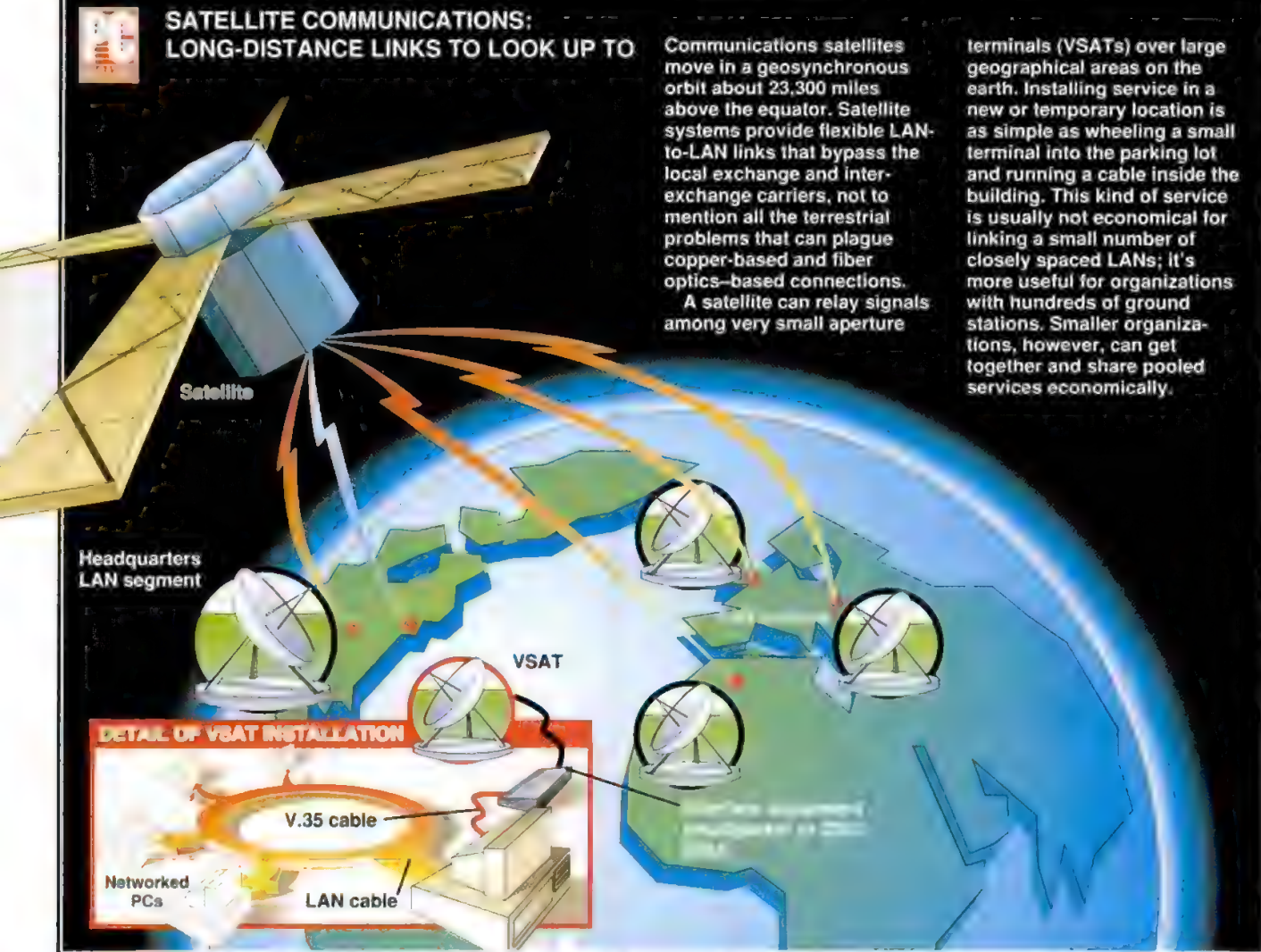
FDDI technology should eventually prove to be an excellent asset for connecting networks in a metropolitan area. Because they use fiber-optic cabling, FDDI systems are free of the electrical noise and data-distorting interference normally gathered by copper cables. Independence from interference allows FDDI

SATELLITE COMMUNICATIONS: LONG-DISTANCE LINKS TO LOOK UP TO

Communications satellites move in a geosynchronous orbit about 23,300 miles above the equator. Satellite systems provide flexible LAN-to-LAN links that bypass the local exchange and inter-exchange carriers, not to mention all the terrestrial problems that can plague copper-based and fiber optics-based connections.

A satellite can relay signals among very small aperture

terminals (VSATs) over large geographical areas on the earth. Installing service in a new or temporary location is as simple as wheeling a small terminal into the parking lot and running a cable inside the building. This kind of service is usually not economical for linking a small number of closely spaced LANs; it's more useful for organizations with hundreds of ground stations. Smaller organizations, however, can get together and share pooled services economically.



Dow Corning discovers powerful solution using Enable Software.



Power outages caused by underground cable failure are a major problem for utility companies. Dow Corning developed a solution that enables utilities to repair damaged cable without excavating. The innovative product is called CableCURE™ Restoration Fluid, and Dow Corning found an equally innovative solution—*Intrapreneurship*—to develop markets for the product. They created an off-site venture and charged two engineers with the mission of building CableCURE Restoration as a separate, profitable business.

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fiber to be installed in ways and places impossible for copper wires.

HELP FROM UNLIKELY SOURCES

In today's high-tech environment, you should not limit your search for efficient MAN connectivity to the major communications companies. You can buy services for LAN-to-LAN connectivity from

some unlikely vendors. For instance, some cable television companies have installed two-way coaxial links able to handle data. Prices for these services are generally based on a complex formula of speed, distance, and cost. Many railroads have fiber-optic cable installed near the tracks,

and some television companies offer their excess microwave capacity for LAN-to-LAN connections. Prices for the latter depend in great part on what the companies have installed. Many specialized companies like DigiNet and Metropolitan Fiber Systems are located in various cities and offer solutions for connecting LANs in a metro area.

LINKING LANs: A Guide to Sources Offering Long-Distance and Metropolitan-Area Services

The challenge in the wide world of wide area networks is not just deciding on the type of long-distance or metropolitan-area link you need. It starts with investigating the services that provide the links. How do you even

begin to find the companies that offer what you need? After all, it's unlikely that you can go into your nearest computer store and pick a very small aperture terminal off the shelf.

We get you started here with a list of

some of the companies that provide long-distance and metropolitan LAN-to-LAN circuits, including interexchange carriers that provide private digital leased lines to the contiguous 48 states.

INTEREXCHANGE CARRIERS:

Advanced Telecommunications Corp.
1515 S. Federal Highway, #400
Boca Raton, FL 33432
800-226-8888

American Private Line Services Inc.
140 Gould St.
Needham, MA 02194
800-624-9203
617-455-9000

AT&T
295 N. Maple Ave.
Basking Ridge, NJ 07920
Contact your local AT&T account representative:
800-346-3288

Cable & Wireless Communications Inc.
1919 Gallows Rd.
Vienna, VA 22182
800-969-9998
703-790-5300

Consolidated Network Inc.
11701 Borman Dr., #175
St. Louis, MO 63146
314-993-9009

MC1 Communications Corp.
c/o Data Marketing
Dept. 0172
1650 Tysons Blvd.
McLean, VA 22102
800-888-0800

Southern Pacific Telecommunications Company, Inc.
60 Spear St., #700
San Francisco, CA 94105
415-541-2000

Sprint Data Group
10951 Lakeview Dr.
Lenexa, KS 66215
800-736-1130
913-541-6876

WilTel
P.O. Box 21348
Tulsa, OK 74121
800-642-2299
918-588-3210

VSAT SERVICE VENDORS:

Alascom
210 E. Bluff Road
Anchorage, AK 99519
907-264-7000

AT&T Tridom
840 Franklin Ct.
Marietta, GA 30067
404-426-4261

AvData Systems Inc.
55 Marietta St. NW
Atlanta, GA 30303
800-476-5915
404-523-2848

Canadian Satellite Communications Inc.
50 Burhamthorpe Rd. West,
10th floor
Mississauga, ON L5B 3C2 Canada
416-272-4960

Computer Power Inc.
P.O. Box 2388
Jacksonville, FL 32231
904-350-1400

Comsat General Corp.
950 L'Enfant Pl. SW
Washington, DC 20024
800-888-0077
202-863-6000

Cylix Communications Corp.
800 Ridge Lake Blvd.
Memphis, TN 38120
901-761-1177

GTE Spacenet Corp.
1801 Research Blvd.
Rockville, MD 20850
800-638-8514
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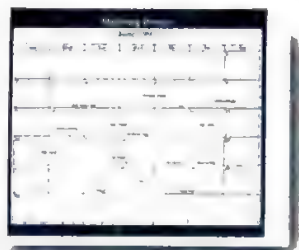
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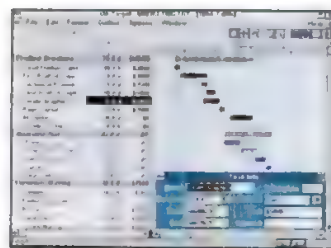
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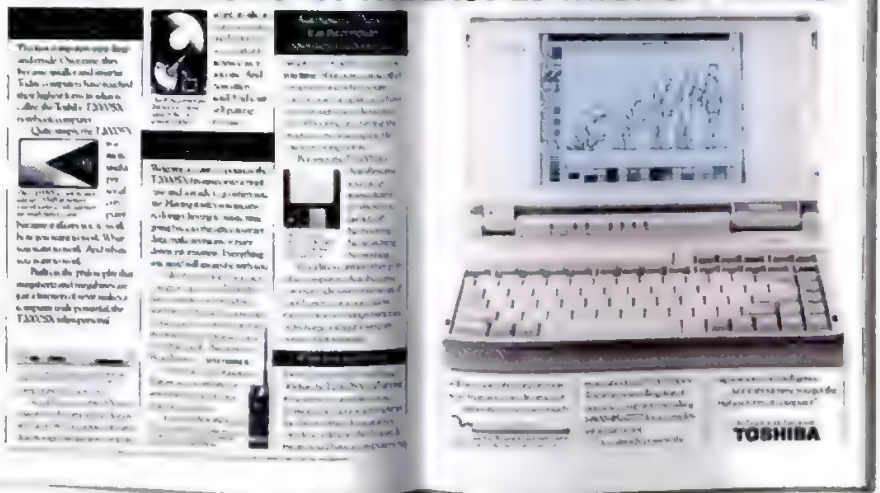
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If you're an independent-minded consumer, companies like M/A-Com, Motorola, and Microwave Networks offer ways for you to set up your own wideband microwave radio system within a metropolitan area. If you can find a line-of-sight vantage point for a microwave antenna, you can aim and shoot data between two locations at throughput speeds of up to 1.544 Mbps. These microwave radios generally operate at a frequency of 23 gigahertz and are limited to a distance of 3 to 5 miles between the antennas. Expect to pay around \$20,000 for the hardware, but no other fees.

ISDN ON THE RISE

Another inter-LAN connectivity alternative, available in a growing number of metropolitan areas, is the *Integrated Services Digital Network*, or ISDN. ISDN is an international program designed to digitize the telephone systems and eliminate analog voice lines.

For local service, the ISDN architecture divides the available bandwidth into three data channels. Two of the channels move data at 64 kilobits per second. The third channel operates at 16 Kbps and provides a path for telephones to send requests to the ISDN switch while moving data from applications at full speed on the data channels. In ISDN systems, the 64-Kbps data channels are called B channels, and the slower 16-Kbps signaling channel is a D channel. The typical type of desktop ISDN service is called *2B+D*, or *basic rate service*.

If you are used to reading about 10-Mbps Ethernet and 16-Mbps Token-Ring, you might assume that ISDN is slow in comparison. But LAN schemes such as Ethernet and Token-Ring use sophisticated media-access protocols to control the access of each node to the cable. LAN nodes must wait, retry, repeat, and perform many overhead tasks to share the cable. ISDN, on the other hand, provides dedicated channels for data transfer.

You need a special ISDN telephone or an internal adapter to connect a PC to ISDN service. The ISDN telephone connects to the PC's serial port, but only at speeds up to 19.2 kilobits per second. Unfortunately, the internal adapters needed to get the benefit of faster ISDN service carry price tags two or three times higher than is practical.

Because an ISDN telephone call is digital, the phones and switches can pass a lot of information about the call. The

people who market ISDN services have focused on a feature called *incoming caller ID*, or ICLID. This feature, which displays the phone number of the party calling you on a digital readout on your phone, has become controversial and the subject of Congressional hearings and legislation in some states. We think the market would benefit if the ISDN community refocused on the movement of data as a more lucrative and less inflammatory way to sell services.

Today ISDN is available only in segments of major cities in the U.S., although it is becoming available more rapidly in Europe and parts of Asia. ISDN should have been in place in the U.S. in the mid-1980s, but the astronomically high price for the PC ISDN adapter cards prevented

.

**Distance, speed, and
cost are factors to
consider in choosing
inter-LAN circuits.**

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the service from becoming popular in those metropolitan areas where it was offered. Some LECs in the U.S. have not even developed tariff schedules for ISDN services, which gives potential buyers legitimate concerns about costs.

If you can get ISDN service and want to use this interesting technology, Microcom's MND/5500 ISDN LAN Bridge is one of the few products in the ISDN arena that makes good sense today. Its retail price is under \$10,000.

Today ISDN is economical mainly for linking LANs, primarily on an experimental basis, but in the near future it may replace and displace the traditional local area network in many installations. Part of the reason is that while ISDN equipment for the PC is very expensive today (\$1,200 and up per PC), those prices are expected to drop in the next year. Also, some of the regional Bell operating companies (RBOCs) plan to make as much as 90% of their lines available for ISDN by 1994.

If you manage a group of PCs in one of the increasing number of areas with ISDN, you need to find out how this alternative

can serve you in linking PCs, mainframes, and existing LANs across the miles (and eventually across the thousands of miles) with fast digital service. Your local exchange carrier is the best source of information about ISDN in your area.

OPTIONS WITHIN OPTIONS

Your inter-LAN circuit choices are driven by the interacting variables of distance, speed, flexibility, and cost. You must factor in how much data you have to move how far over what increment of time. For example, using e-mail gateways to move messages between different LANs does not require high-speed, full-time links. Dial-up voice lines or leased lines running at 19.2 Kbps can support the e-mail needs of large organizations.

If you're using bridges or routers to carry traffic between LANs, the applications running on the network will determine the types of links you need. Often you will require nothing more than the services of a public data network. But meeting the needs of even a few people transferring large graphics files, such as those used in medical imaging, can force a company to adopt the use of high-speed links operating at 1.544 Mbps or better. And when many people on one LAN segment are updating a database on another LAN segment, they may not move much traffic, but they need to move it quickly so they do not have to wait for data entry screens.

Devices that typically use asynchronous modems and dial-up lines, such as access servers, wide-area information transfer systems, and bulletin board systems, can employ fractional T1 channels to carry data economically between two locations. But since these access servers and bulletin boards often serve traveling members of an organization, it is often more appropriate to equip them with toll-free numbers from the public dial network for easy access. In fact, users dialing into access servers typically use the public dial network.

Deciding on the best service for LAN-to-LAN connectivity is not an easy task. It requires a determined understanding of your present and future needs, as well as the patience to wade through the mounds of available information. But once you decide upon the transport media best suited to your needs and get your system up and running, the extended reach of your organization will show that it has all been well worth the effort. ■

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PUBLIC DATA NETWORKS

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that will move
your data reliably
among several
business locations.

Reliable Relays

BY FRANK J. DERFLER, JR., AND KIMBERLY J. MAXWELL Anyone who transports goods or other materials in the course of business faces the option of either acquiring trucks and hiring drivers or of contracting the transport services of another company. The right choice depends on many factors—among them the volume of traffic, the distances and territories involved, the funds available, and the management's consensus regarding long-term investment.

The same considerations apply to the transport of

CONNECTIVITY

PUBLIC DATA NETWORKS

data. You can create your own interlaced network of leased telephone lines, Switched 56 services, microwave circuits, or even satellite links (see the article "The Media Move the Message" in this issue), or you can lease most of these same services from other companies. Known as public data networks, or PDNs, these companies will accept your data at local access points, route it to its destination, maintain protection along the way, and guarantee its delivery. PDNs offer many organizations an economical way to link their LAN segments, particularly when traffic flows among three or more locations.

More specifically, PDNs consist of computer networks connected over telephone lines that can span much of the globe. The computers within the PDN act as switches, routing packets on the fly among the various points where customers access the network's services.

Other sections of this special issue describe bridges, routers, and electronic mail gateways—the network devices that act as portals between LAN segments. (The PCs linking a user network to a PDN can be equipped with some of the bridges or routers we review in the article that "Smart Links Between LAN Segments.") In this issue, we also describe your options for circuits that link LAN segments, including leased and dialed telephone lines, as well as more-specialized systems such as satellites and ISDN. This section focuses on public data networks, an important and specialized way to link entire LANs.

SURVEY CRITERIA

Some PDNs lease the connecting circuits between their switches from the long-distance telephone carriers; other PDN companies, notably AT&T and U.S. Sprint, are prime long-distance carriers in their own right. Because PDNs add value to the telephone-line connections in the form of error control, redundancy, and reliability, they are also known generically as value-added networks, or VANs. Private corporations can and often do establish their own VANs.

In this section of our special LAN-to-LAN coverage, however, we focus on publicly—and nationally—available VAN services that use the X.25 packet-switching protocol. Included are descriptions of services offered by AT&T, BT North America, CompuServe, GE, IBM, Infonet Services, and U.S. Sprint. These

companies' solutions can carry your data throughout North America, Europe, and, in some cases, to many other portions of the world. (In our sidebar "Datapac: A Look at Canada's National X.25 Carrier," we also look at the Datapac service maintained by Telecom Canada; it is the country's national X.25 carrier and provides broad service in that country, as well as between the United States and Canada. However, you cannot access the Datapac network from outside Canada.) We'll also describe two emerging technologies—frame relay and switched multimegabit data services (SMDS)—that will inevitably both enhance and confuse the PDN picture.

Not included among the companies surveyed are the PDN vendors you might find in your own region of operation. Almost all of the local exchange carriers—the local telephone companies—offer some X.25 PDN service within their service areas. In Europe, where public data networks have been an important part of business life for some time, governmental ministries usually furnish X.25 services (see the sidebar "Overseas Communications: X.25 and the European Public Data Network").

There is no single hard-and-fast price to quote for each company's public data network services. To establish a frame of reference, we gave the seven national PDN companies a scenario for the connection of four U.S.-based LAN segments. Our question: How would these vendors recommend connecting the segments together, and at what price (see the sidebar "Pricing the PDNs: An Installation Scenario").

In our scenario, we assumed the full use of electronic mail among all LAN segments plus a heavy data flow between the individual segments (in Dallas, San Francisco, and Seattle) and the LAN at the New York headquarters. We also assumed full 24-hour-daily technical support, which each company offers for the duration of the customer's need for the service. Each company also maintains an 800 number (or a local number in foreign countries where there is no 800 service) and supplies all the training.

The formulas the companies used for their replies varied significantly. Where possible, we supply details on their approaches, though not all companies were willing to furnish information on their



PEERING THROUGH THE CLOUD: AN X.25 PACKET-SWITCHING NETWORK TOPOLOGY

An X.25 packet-switching network is typically represented as a cloud, its intricate details obscured. This x-ray view of a relatively simple cloud shows a number of minicomputers acting as switches connected by a web of alternative communications circuits. The web of circuits is carefully planned according to data traffic studies and estimates of the reliability of each path.



While the software in each switch will typically route a packet over the most direct physical path, there are often times when line outages, equipment malfunctions, or heavy traffic in one part of the system force the software to route packets through one or more switches to the final destination. The software follows elaborate routing algorithms that

consider delay, reliability, and other factors for each packet.

The switches connect outside the cloud using both dial-up and leased-line circuits. A leased line is used in conjunction with a packet-switching node, such as a PC with a bridge installed, on the customer side. Typically the dial-up lines terminate in a modem that feeds a minicomputer-based packet switch fitted with a

packet assembler/disassembler (PAD). The data between the customer location and the switch being dialed is protected only by MNP 5, V.42bis, or some other modem-to-modem protocol—not by the X.25 protocol. The leased lines, however, originate in a PAD at the customer location; therefore the PDN's minicomputer acts only as a switch and doesn't need to assemble or disassemble packets. As a result, full X.25-assured data delivery, covers the entire link.

Note: Each networked PC or networked PSN also functions as a bridge or router.

X.25 cloud

Client leased lines

Client dial-up lines

Networked PSN (acting as bridge or router)

Networked PC (acting as bridge or router)

Minicomputer-based packet switch

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**The Past, Present, and Future
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CIRCLE 322 ON READER SERVICE CARD

GLOSSARY: X.25 Public Data Networks

by Frank J. Derfler, Jr.

■ call clear packet

An informational packet that terminates an X.25 communications session, performing the equivalent of hanging up the phone.

■ call request packet

A packet that carries information, such as sender and recipient identification, that is needed to establish an X.25 circuit.

■ CCITT X.25 recommendation

An international standard, administered by the Comité Consultatif International Télégraphique et Téléphonique (CCITT), that defines communications protocols to be implemented in an X.25 public or private network.

■ circuit switching

A method of communicating, used on a voice telephone system, in which a dedicated communications path is established temporarily between two devices. The bandwidth of the signal is guaranteed until the termination of the call, and delay is essentially limited to propagation time—for example, the nominal time it takes the electrical signal to cross the wires.

■ data communications equipment (DCE)

A term describing any network component that implements the CCITT X.25 standard to establish X.25 communications. Packet-switching nodes (PSNs), for example, are typical X.25 DCEs.

■ data packet

A packet that transports full-duplex information—the actual user data intended for transmission—via an X.25 circuit. The default size of X.25 data packets, not including addressing and routing information, is 128 bytes.

■ data terminal equipment (DTE)

Any end-user device that can access an X.25 network using the CCITT X.25 standard, X.25 PLP (see *packet-level procedure*) or other procedures.

■ frame

Generally, a group of data bits in a specific format, with a flag at each end to indicate the beginning and end of the frame. The defined format enables network equipment to recognize the meaning and purpose of specific bits.

■ frame relay

A simplified form of packet switching that can be used for intelligent protocols running over very clean transmission lines. Because it allows for none of the error correction, flow control, and sequencing overhead of X.25 transmission, users can potentially pay the same rates for greater throughput at the same transmission speeds. Under frame relay, error-correction functions are performed by high-level software elements at each end.

■ Local Management Interface (LMI)

A specification for use by frame-relay products that defines a method of exchanging status information between devices such as routers sending or receiving data in the networks.

■ message switching

A communications method that uses a message store-and-forward system in which no dedicated path is required. Each message, like a Western Union telegram, contains a destination address and is passed from sender to recipient through intermediate nodes. Each node along the way receives the message, stores it briefly, and then passes it on to the next node.

■ network layer

Sometimes called the *packet layer*; the software that determines proper routing of data from one device to another.

■ packet

An electronic envelope, or fixed-size block of data, sent over a network. Each packet contains user data (the actual data transmitted) plus information such as addressing (the identity of the sending and receiving stations), sequencing, and error correction.

■ packet assembler/disassembler (PAD)

A hardware/software combination that forms the interface between an X.25 network such as a PDN and an asynchronous device such as a PC. The PAD generates call request, call clear, and other informational packets in addition to the ones that contain user data.

■ packet-level procedure (PLP)

A full-duplex protocol that defines the means of packet transfer between an X.25 DTE and an X.25 DCE. It supports data-packet sequencing, flow control (including maintenance of transmission rates), and error detection and recovery.

■ packet switching

A method of data transmission that makes the most of digital transmission centers by simultaneously sending data packets from many customers over a single communications channel such as a telephone line.

■ packet-switching network

A group of interconnected computers acting as packet switches and routing packets from sender to receiver. In public packet-switching networks, packets travel over network facilities shared by a number of subscribers, eliminating the cost of a dedicated line between sender and receiver. The sender and receiver simply require an access line to the closest network access point. Public packet-switching networks save users money by billing based on connection time and the number of packets sent rather than by distance.

■ physical layer

The wires, cables, and interface hardware that connect devices on the network.

■ public data network (PDN)

Any packet-switching network with services publicly available to data processing users.

■ reset packet

A packet that identifies error conditions on an X.25 communications circuit. The reset packet does not clear the session but rather notifies the communicating DTEs of error conditions at a known point in the data-packet transfer sequence.

■ restart packet

An informational packet that notifies DTEs of an irrecoverable error within the X.25 network.

■ sequencing

The process of properly ordering the receipt of data packets at their destinations, regardless of the time they have taken to traverse the network.

■ Switched Multimegabit Data Service (SMDS)

A system allowing data from private computer networks to travel at higher speeds and more economically than within an X.25 network. The concept of SMDS resulted from work at Bell Communications Research and is implemented using fiber-optic cabling over the public telephone system in metropolitan or wide area networks.

■ value-added network (VAN)

A network that uses techniques such as X.25 packet switching to provide error correction, redundancy, and other forms of network reliability. Organizations may set up their own value-added networks, or—as in the case of PDNs—the VANs can be run as commercial enterprises whose services are sold to the public.

■ X.25 network

Any network that implements the internationally accepted CCITT standard governing the operation of packet-switching networks. The X.25 standard describes a switched communications service where call setup times are relatively fast. The standard also defines how data streams are to be assembled into packets, controlled, routed, and protected as they cross the network.

pricing policies. The final results were also heavily influenced by the amount of data sent across the PDN. Still, all companies that supplied prices estimated them at between \$3,525 and \$4,700 a month. These prices do not include the expense of dial-up services, however, as these are priced individually by distance, locality, and the rates of your local exchange carrier. They also don't account for any terminating equipment such as PADs and modems.

One result of the vast differences among the services that PDNs furnish is that *PC Magazine* has departed from its usual practice of selecting an Editors' Choice. While products (in this case, services) can often be categorized into low- or high-end or some other classification, no clean way exists for us to choose one or even two winners from among the more than two dozen X.25 services offered by the seven companies discussed here. Every customer will have a distinct set of requirements based on such criteria as the type of networks transmitting and receiving data; the amount of data, as well as the importance and timeliness of the data transmitted; and the extent of investment that the customer's management is willing to make in terms of leased lines and the additional hardware or software needed to expedite data flow.

A CLOSE LOOK AT X.25

The CCITT X.25 protocol describes how data communications devices like bridges and routers package data into specially addressed and configured packets. It also details how the VAN's computers, acting as switches, route these packets through the network toward their destinations (see the diagram "Peering Through the Cloud: An X.25 Packet-Switching Network Topology").

X.25 begins with the packet, an electronic envelope that is typically 128 bytes long. The protocol allows for a variety of packet types to be transmitted, of which only some may contain some of the actual data being sent.

A packet-switching node (PSN), which may be a PC or a network, runs software with accompanying hardware called a PAD (packet assembler/disassembler). The PAD creates and transmits packets; it also receives incoming data from the public data network and breaks down the packets into usable data. Although the PAD generally comes in the form of an

adapter board with its own processing capability and software, Hayes Microcomputer Products incorporates the required PAD circuitry into its Smartmodem V-Series models. The packets to be relayed through the PDN are interleaved on a circuit with packets transmitted by other PDN customers to make the best use of whatever bandwidth is available—hence the word "public" in PDNs.

In order for a PAD to establish an X.25 circuit and pass information, it must follow a specific order of packet exchange. First, the PAD sends a *call request packet* to the requested host (in this case, the PDN), which issues a *call accepted packet* to grant permission for further exchange. Once the call is set up, data is exchanged in the form of packets that include addressing information as well as the actual data comprising the purpose of the transmission.

Throughout the process, every packet sent has a clearly specified structure, with every field defined. A *call clear packet*, sent by the PAD, initiates the termination of a call; the exchange ends when the PAD receives acknowledgement in the form of a *clear confirmation packet*. Other packet types that add to X.25's strength include special *reset* and *restart packets*, along with other X.25-specified packets such as the *diagnostic packet*, which checks the status and efficiency of the network. Overall, they help make the X.25 protocol both versatile and easy to use.

At the heart of the value-added network itself is a group of networked computers (often depicted on diagrams as a *cloud*) with a variety of connections leading in and out. The image is accurate, especially for PDNs, since the minicomputers operating within are complex both in their connections and in the resulting types of services that this setup makes available to customers.

PDN access services can be readily lumped into two categories: *leased access* and *dial-up access*. Leased access lines, often synchronous for greater throughput, can carry data at signaling speeds of 19.2, 56, or 64 kilobits per second (or even 1.544 Mbps) using full X.25 protocols from the customer's network to the cloud. This particularly expensive connection is best reserved for the busy headquarters segment of the LAN that serves as the focal point for traffic with other LAN segments—typically in branch offices. The other type of connection, a dial-up telephone line, is convenient and rela-

tively inexpensive for users. This often-asynchronous (synchronous modems are not inexpensive) connection does not provide full X.25 data handling between the computer and the X.25 network. Error correction between the customer and the PDN, in this case, is provided only by the asynchronous modem transmitting the data to the PDN. Typically, dial-up services range from 300 to 9,600 bps, although some services allow speeds up to 19.2 Kbps and even 56 Kbps.

FRAME RELAY

The X.25 protocols and products underlying the PDNs are proven, stable, and reliable. Why would any user want it any other way? The answer lies in a concept called frame relay, which has been generating a growing level of interest since its beginnings in 1988. Today's frame relay, in fact, takes its form through evolving ANSI and CCITT standards that challenge the supremacy of X.25.

To summarize, the X.25 protocol conservatively numbers, acknowledges, and shepherds every packet toward its destination. It even retransmits packets that don't make the trip across the network. This design does protect data, but it also uses a lot of expensive computing and communicating resources.

The frame relay protocol is based on two assumptions: that modern transmission systems are quiet and reliable, and that reducing the protective overhead will allow more throughput at lower cost to users. The frame relay concept, in other words, removes some of the responsibilities of the VAN and puts them on the terminal equipment on each end.

If there is a problem, the frame relay network discards the data and expects the terminal equipment (managed by the customer) to take the corrective action. For many users, this may pose no problem at all. Because LAN protocols such as Novell's SPX/IPX have their own error correction, which is redundant with the error correction in X.25, they fit nicely into the frame relay architecture.

Since PDN companies and others who make termination equipment and products like bridges and routers are generally excited about frame relay, PDN vendors should eventually offer it in addition to their X.25 services. But there's a hitch: As we put this story to bed, you still could not buy frame relay services from the PDN companies. Yes, you can certainly buy a frame relay switch from a company like

Netrix Corp. and establish your own network, but the PDN companies are still making the transition to offering frame relay services.

Because frame relay uses little processing power on the network switches, they can pass both frame relay and X.25 packets on the same network. Certainly, some of the PDN companies surveyed here will move quickly to capitalize on the high interest in the practical frame relay services, but no prospective prices were available at press time.

SMDS ON THE WAY

Another emerging standard that confuses the PDN market is called Switched Multimegabit Data Service (SMDS). Developed by Bell Communications Research (Bellcore), the research arm of the seven

.
**X.25 protocols are
proven, stable, and
reliable—who would
want it any other way?**
.

regional Bell holding companies, SMDS will provide multimegabit circuits, typically over fiber-optic cables, to link computers so as to move large amounts of data that would otherwise pass over X.25 channels too slowly.

Initially, SMDS will be confined to the local access and transport area (LATA) served by a local exchange carrier. Links between SMDS switches from different carriers are not expected until 1992. But when the links do become available, users will be able to build a national or international high-speed data network using SMDS.

SMDS uses speeds matching and exceeding those of T1 to create large public networks. With the full deployment of SMDS, you'll be able to dial any computer in the world with a SMDS address. This, in effect, creates a universal "dial tone" for data.

As for cost, some of the Bell operating companies suggest that SMDS rates will be similar to those of private lines. Until

these rates are set, however, there is no accurate way to pinpoint the costs of SMDS.

The seven Bell companies plan a three-phase introduction of SMDS. Planned for completion this year, *Phase 1* defines the service that provides wide area connectivity with LATAs. *Phase 2* will specify the interfaces between local exchanges and interexchange carriers. Within this phase, SMDS will be able to operate both nationally and internationally. In *Phase 3* (proposed for 1995), high-speed access interfaces will be incorporated into SMDS. At this point, we will also see the introduction of broadband ISDN switching technology into local exchange carrier networks. These LECs will then support an array of broadband services, including the high-speed transmission of digitized voice and video.

Large leased-line carriers like MCI are looking to SMDS as a solution for future wide-area networking. Tests with some of the larger local carriers, according to the company, will take place over the next few years. MCI is also looking at broadband ISDN and other communications options.

SMDS testing is already taking place. Bell Atlantic Corp. in Philadelphia is conducting a trial with Temple University, where a number of LANs and a data center on the main campus are connected to the LANs at the university's health and science campus with a high-speed link. Another trial, being performed by Pacific Telesis in San Francisco, involves a number of customers including Sun Microsystems, Stanford University, Apple Computer, Tandem Computers, Cisco Systems, and Pacific Gas and Electric.

SMDS is more adaptable to existing communications technology than the FDDI specification for fiber-optic networks. It is a carrier-provided service and will need few changes to adapt to customer equipment. Whereas FDDI networks perform more effectively in dedicated fiber-optic line environments, SMDS, instead, is based on standard public network speeds.

PICK A TECHNOLOGY

Public data networks offer a wide variety of alternatives for LAN connections. Priced by factors such as usage or flat rates (depending on the particular service you're accessing), PDNs offer a flexible, portable, expandable, method of moving data between LAN segments.

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CIRCLE 495 ON READER SERVICE CARD

Current X.25 PDNs work well in many applications that require multiple protocols, low delay, and connections to multiple hosts for short periods of time. Down the road, more options, such as frame relay and SMDS, will become available to PDN customers.

The choice between using a PDN and creating your own network of private or dialed lines involves more than monthly costs. The decision also involves making long-term economical and technical investments in the future of your organization. Some organizations will surely opt to control their own data transmission systems, although they gamble on their ability to make use of new technology (such as frame relay) as soon as it becomes available. Other organizations will instead prefer to leave the technological means of transport in the hands of others, soliciting the aid of a public data network with a flexible range of services.

AT&T COMPUTER SYSTEMS **Accunet**

All reviews by Sara Parker
and Ed Perratore

.....

With a name that's a synonym for telephone communications, AT&T takes its services far beyond a mere long-distance voice carrier. The company has been in the public data network business since the mid-1980s, primarily represented by a PDN called Accunet.

AT&T's selection of services includes its X.25 Accunet Packet Service, as well as its Accunet Switched Digital Service and Software Defined Data Network (SDDN), which are not X.25 networks. All are available in more than 400 U.S. cities nationwide; international service is available as well.

SERVICE OVERVIEW

A typical dial-up packet-switching network, Accunet Packet Service offers speeds of 2.4, 4.8, 9.6, and 56 kilobits per second (Kbps). Access is generally on a dial-up basis from networks already fitted with all hardware that may be necessary, such as PADs, routers, and bridges. But if you plan high-volume use—for example, several users transmitting data from within one concentrated area—you're probably best off using dedicated lines to the Packet Service. AT&T Analog Private Line or Dataphone Digital Service will provide these lines.

Accunet Packet Service is priced by connect time. The vendor's network control center monitors the network 24 hours daily to troubleshoot and solve any problems that might otherwise interrupt transmission.

If X.25 service will not do for such applications as Group 4 Facsimile or video teleconferencing, AT&T offers services on digital lines that typically do not require X.25 error correction. One of these, Accunet Switched Digital Service, offers faster transmission than Accunet Packet Service and is intended primarily for end-to-end (which may include company-to-company) transmission. The types of service available are priced by usage depending upon the speed you choose: Switched 56 (56 Kbps), Switched 64 (64 Kbps), and Switched 384 (384 Kbps). Switched 1536 (1,536 Kbps), the most recently added option, is especially appropriate for high-speed transmission.

Another non-X.25, dial-in switched service available is AT&T's Software Defined Data Network. Marketed differently from other AT&T PDN services, SDDN relies on the simple fact that all switched networks use computers in their switching centers and that these same computers can be programmed to render special services to designated customers. When you go off-hook on a phone line attached to a Software Defined Data Network, the network knows who you are and to whom you want to connect. The resulting connection is made automatically, providing a virtual private-line circuit.

Where Accunet Switched Digital Service is primarily point-to-point, SDDN is

intended for customers with several locations (within one company) that make many calls among those locations. SDDN is also available at the same speeds as Switched Digital Service, with the exception of 1,536 Kbps.

USAGE SCENARIO

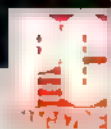
For our LAN-to-LAN usage scenario (see the sidebar "Pricing the PDNs: An Installation Scenario"), AT&T recommends a dedicated link to its X.25 Accunet Packet Service. At the speeds noted, this leased line would result in a recurring charge of \$1,200 a month for the New York office and \$700 a month for the other three branches. If you apply peak usage times to calculate the tariff charges (\$0.69) and a packet size of 128 characters per kilopacket, the total usage charge for all four sites comes to \$1,200.

Add the usage charge to the recurring monthly charge for the four sites, and the total monthly charge for Accunet Packet Service under our scenario is \$4,500. You can receive discounts of 5 to 25 percent on this service should you commit to a volume or long-term contract with AT&T; all other PDNs in this roundup also offer discounts under similar plans. Of course, discount percentages vary among vendors.

A new AT&T service, released in July of this year, is the company's Information Access Service. Intended primarily for Accunet Packet Service customers who regularly access third-party on-line databases, IAS allows users to dial the toll-free 950-1288 from anywhere in the United States. A customizable menu appears that allows users to choose from among the third-party services available under IAS, eliminating the need to pay the local dial-up charges usually associated with on-line database access. Information Access Service users pay an extra flat-rate fee, based upon speed (300 to 9,600 bps) and expected usage, on top of their regular Packet Service charges.

Information Access Service will eventually offer international connectivity. (A toll-free number is also available for those cities where 950-1288 is not directly accessible.)

AT&T has not announced plans to offer frame relay service. However, should you need more than a public X.25 network (when traffic, for example, becomes too heavy), AT&T offers many private-line network alternatives in addition to the digital services described.



FACT FILE

Accunet
AT&T Computer Systems, 295 N. Maple Ave.,
Basking Ridge, NJ 07920; 800-222-0400, 201-
993-4500.
Price: Varies.
In Short: AT&T's Accunet PDN offers
international service with a variety of
connection options. For a fee, users of the
X.25 Accunet Packet Service can use the
company's Information Access Service, which
lets them avoid the local dial-up charges
usually associated with accessing third-party
on-line databases. The Software Defined Data
Network option offers high-volume
transmission for applications like video
teleconferencing.

CIRCLE 426 ON READER SERVICE CARD

STAT 101 PR.P. GOSSET 10/11

→ Measures of Central Tendency

arithmetic mean = "average" = $\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$

median = middle value

mode = most common value

skewness to right and to left

→ Measures of Dispersion (or "spread" of the data).

Variance = $s^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2$ (unbiased w/ n-1 in denominator)

Standard Deviation = $s = \sqrt{s^2}$

Coefficient of Variation (c.v.) = $100 \left(\frac{s}{\bar{x}} \right)$

→ Sampling Distribution of the Mean:

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$. We estimate σ with s , taking large n .

For $n \rightarrow \infty$, $\bar{x} \sim N(\mu, \sigma_{\bar{x}})$

(68% within 1 std. error, 95% within 2)

→ Least-Squares Regression:

Given X , estimates b , dependent values Y

$Y = Xb \Rightarrow b = (X'X)^{-1} X'Y$

$\sum_{i=1}^n (y_i - \hat{y}_i)^2$

GOSSET Stats 101

Meeting in Chem Bldg. 7:30

measures of central tendency

mean = average = $\bar{x} = \frac{\sum x_i}{n}$

median = middle value

mode = most common value

skew = right

skew = left

variance = $s^2 = \frac{1}{n-1} \sum (x_i - \bar{x})^2$

standard deviation = $s = \sqrt{s^2}$

coefficient of variation = $c.v. = \frac{s}{\bar{x}} \times 100$

normal distribution

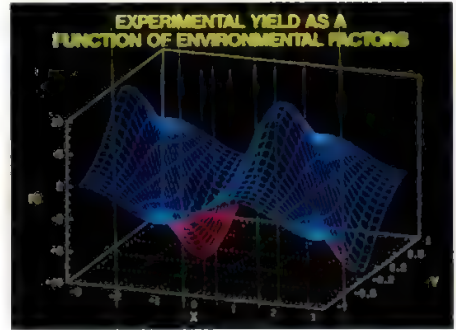
sketch of a normal distribution curve

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PRICING THE PDNs: AN INSTALLATION SCENARIO

During our study of the many available public data network services, we quickly realized that each one takes a different approach to the problem of LAN-to-LAN connectivity. That makes head-to-head comparison of the services trickier than usual, particularly in the context of pricing. For each company, prices might vary based on more individualized statistics than we could possibly incorporate into a single price-comparison scenario, such as who will need access to the PDN, how the customer network is organized, the time of day the connections are made, and the type of data transmitted, among other factors.

Even though we could not take all these factors into account, the chart on this page uses a real-world scenario to give a reasonable perspective on the cost of the services these companies offer. We gave each PDN company the information that follows and asked which services it would recommend for this theoretical customer's needs, and what the estimated monthly charge would be. Some companies preferred not to disclose pricing information.

In our scenario, an organization has four operating locations connected via an X.25 PDN. Each operating location has an installed LAN running Novell's NetWare over

Ethernet and an X.25 bridge. Most of the LAN-to-LAN communication takes place between the New York office and each of the three branch offices, but the three branch offices also communicate among themselves using electronic mail.

■ **New York (national headquarters):** A 24-hour-a-day operation with a high volume of data. This office transfers 10 million characters of data daily at a speed of either 56 or 64 kilobits per second.

■ **San Francisco (regional office):** An 18-hour-a-day operation (no weekends) with a moderate data rate. San Francisco moves 2.5 million characters daily at either 9.6 or 19.2 kilobits per second.



PUBLIC DATA NETWORKS: SERVICE RECOMMENDATIONS AND PRICE QUOTES

Services listed in alphabetical order

	AT&T Accunet	CompuServe Inc. CompuServe Network Services	BT North America Inc. Tymnet Global Network
New York (headquarters)	X.25 Accunet Packet Service (\$1,200/month), plus \$1,200 total usage charge for all four branches (assuming peak usage times)	Fixed-LAN service (\$2,000/month) or Fixed-X.25 service (\$1,750/month)	Tymnet Dedicated X.25 Interface at 56 Kbps (\$2,800/month)
San Francisco (regional office)	X.25 Accunet Packet Service (\$700/month)	Fixed-LAN service (\$900/month) or Fixed-X.25 service (\$700/month)	Tymnet XLink Express at 9.6 Kbps (\$850/month)
Seattle (branch office)	As above	As above	TymDial X.25 (\$500/month)
Dallas (branch office)	As above	As above	Tymnet X.25 OutDial Service (\$285.30/month)

IBM Information Network IBM offers an X.25 service but would not supply further information for our scenario.

Infonet Infonet Services Corp. recommended X.25 Network Service, at a total price of \$3,525 per month, but did not supply a cost breakdown (cost per branch). This price assumes that the client company is using its own modems and DSUs (data service units) and is accessing the network via a local telephone company.

Mark*Net General Electric Corp. recommended its X.25 bidirectional virtual circuit service but did not specify the price.

SprintNet Data Network U.S. Sprint recommended LAN Reach X.25, with a total price of \$4,000 to \$4,700 a month, depending on whether X.25 or asynchronous dial-up access is used. The company did not supply a cost breakdown.

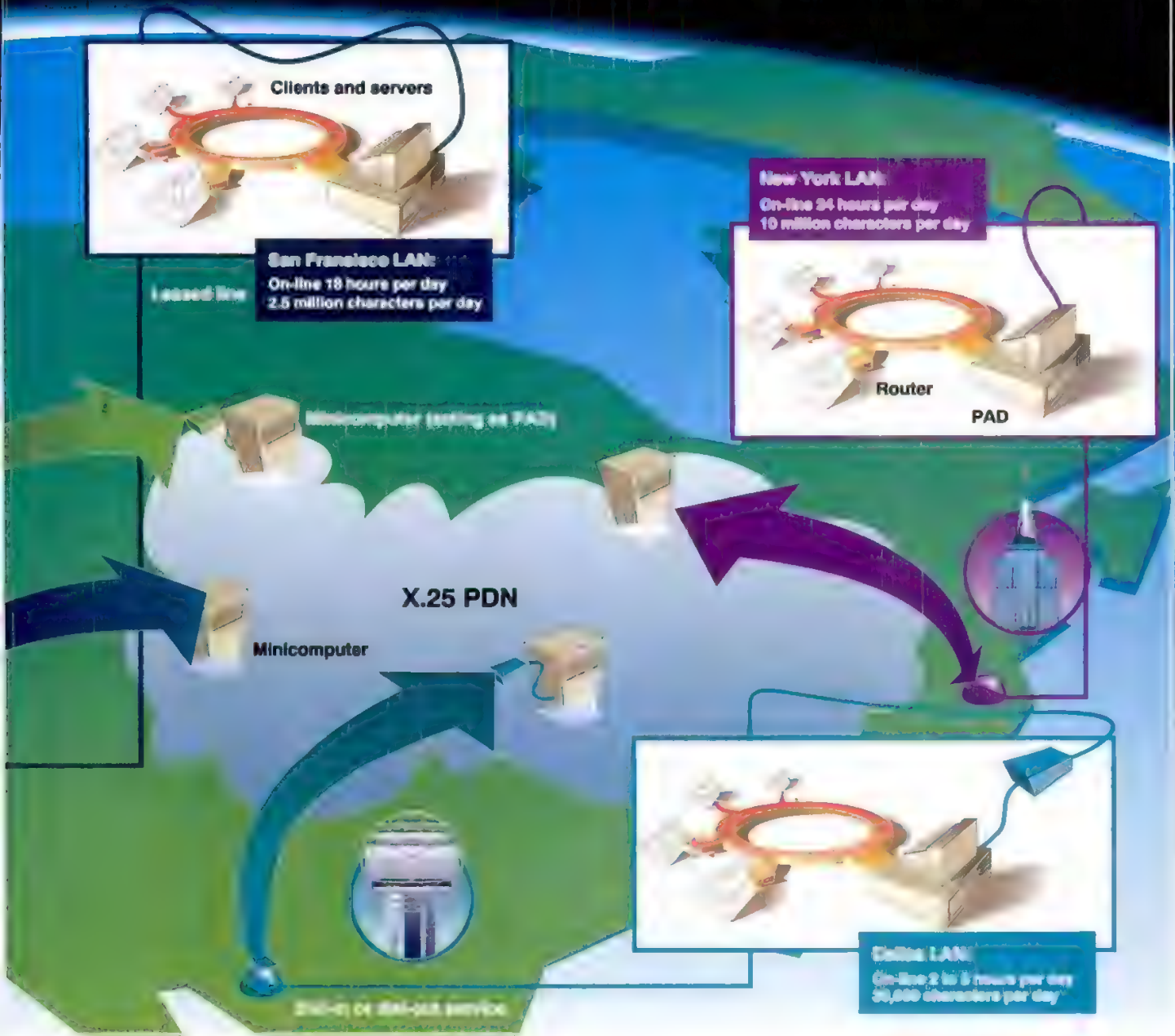
CONNECTIVITY PUBLIC DATA NETWORKS

■ **Seattle (branch office):** A 10-hour-a-day operation with a low to moderate data rate. This office moves 1 million characters daily at 9.6 kilobits per second.

■ **Dallas (branch office):** This office has a low-volume data rate and operates for merely 2 to 3 hours daily. It transfers 30,000 characters daily at 9.6 kilobits per second.

The price quotes we received did not reflect the cost of dial-up access lines (where needed) between the customer's location and the PDN point of access, because dial-up lines would be supplied by the user's own local exchange carrier. Since leased lines are supplied by the service company, when a service uses them, their prices figure into the quotes.

While the formulas that companies used to determine the pricing differed significantly, the total monthly charges did not. For the five companies that cited a monthly total, the charge ranged from \$3,525 to \$4,700. These vendors asked us to emphasize that many service alternatives, pricing schedules, and discounts are available. The major lesson we learned: Recruit competitive bids for the PDN service your organization needs.



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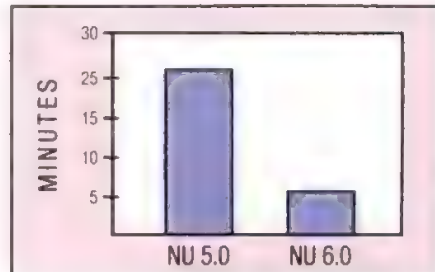
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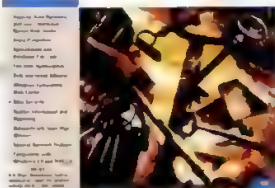
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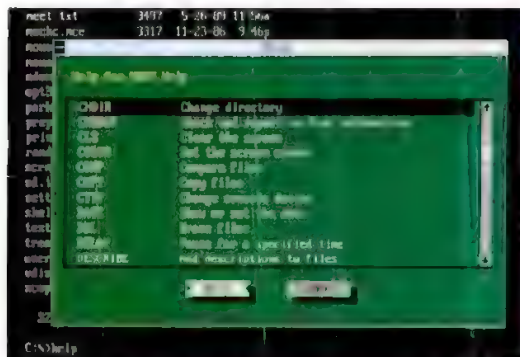
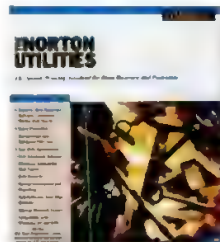
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SYMANTEC.

OVERSEAS COMMUNICATIONS: X.25 AND THE EUROPEAN PUBLIC DATA NETWORK



by Joe Rodriguez

In North America, PDNs refer to private companies whose services and rates are, to some degree, regulated, yet privately owned and operated. Talk about PDNs in most European nations, however, and you're discussing government-run enterprises with few or no market pressures. Here's a look at the differences among the varying implementations of X.25 packet-switching networks.

Theoretically, European X.25 communications should be identical to those of North America. The CCITT X.25 protocol, after all, was conceived and adopted by an international standards body. But in practice complexities have arisen through the number of countries that have connected their X.25 networks to provide multinational services. While standards can and do bring networks together, equipment used in the network's "cloud" may differ from country to country. So will the services available, level of competition (in nations allowing it), and pricing options.

GOVERNMENT-RUN

In Great Britain, commercially run PDNs are the way to go since the privatization of what is today BT Tymnet. In the rest of Europe, X.25 services are provided mostly by each nation's PTT (Postal, Telegraph & Telephone), a government ministry.

A PTT offers on-demand, usage-

based data communication service. PTT's support asynchronous and X.25 (along with its subset X.3, X.28, and X.29 standards) protocols to customer sites. Some even support synchronous and IBM 3270 protocols. Both dial-up and dedicated access are available, and the North American practice of dialing collect to a host network may soon be offered as well.

But where a North American PDN's customers expect a range of services, support, and volume discounts from telecommunications companies competing for their dollars, customers operating within a country like Austria, Spain, or Greece face a chillier reception. There, no privately owned public data networks can operate. France, Germany, and Italy do allow privately owned PDNs to run their own access points. By and large, however, PTTs are less compelled by economics to woo customers through custom service/pricing plans.

If you are in Europe and need to access X.25 services, you must apply at your local PTT for a Network User Interface (NUI), an account used for billing purposes. Connectivity between North American and European PTT networks—and, depending upon country, even via a PDN such as SprintNet—also involves monthly charges billed through an NUI. A privately owned PDN operating within a European country may need to pay an access charge to a PTT; any such costs are passed along to you, the customer.

It generally doesn't take long to establish an NUI and set up dial-in service to a PTT's public data network. But where delivery of leased-line service here can take less than about 20 business days, the same thing in Europe may take 45 to 90 business days.

There also are compatibility issues.

Soon after the CCITT approved the X.25 standard, companies such as Telenet (now SprintNet) and Tymnet improved on certain communications parameters to create more robust features sets—but ones that were incompatible with the international standard. When logging on to a European-based PDN, you'll need to follow the accepted CCITT standard if you want to avoid problems.

The pricing structure of European PTT X.25 service is similar to that of North American PDNs. There are variable monthly costs, which are based on packet counts and connect time, and there are fixed monthly charges for dedicated access lines and NUI charges.

Remember the cost of a North American/European link in your calculations. Cable link costs, access charges, and other fees make costs for X.25 communications between North America and Europe approximately 300 to 400 percent greater than costs for X.25 communications within North America. Rates directly or indirectly paid to a PTT also reflect the distance covered.

North American X.25 PDN service providers can act as your agent in establishing an NUI in Europe. In fact, it's a good idea to consult a North American company for advice on using its services or a PTT's services. A North American X.25 PDN may have a service access point in a desired country.

THE PTT OF 1992

Once the mechanisms of 1992's European Community are fully set into motion, the cost of European X.25 services will drop. Each country in the coming European Community (plus a growing number of countries in eastern Europe) is also currently negotiating ways it can restructure its own PTT to allow for intercountry communications as well as private-sector competition in the X.25 PDN service market. The result? A potential increase in overall quality.

Though a private-sector PDN may still need to pay a PTT for a variety of services, the shared goal—increased gross national product—can only be achieved through policies that encourage the influx and expansion of new businesses. This means good news for companies branching out across the water in the coming years. ■

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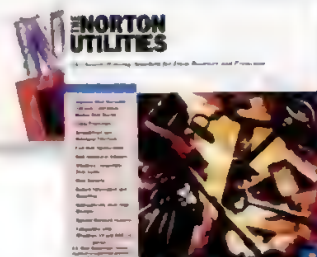
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COMPUSERVE INC.

CompuServe Network Services

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CompuServe Information Service is a familiar on-line presence to many a PC user, but there is another arm of CompuServe that is even more important to corporate users. That part comprises such packet-switching offerings as X.25 dial-up access, dedicated access, and host interface services. Available since the early 1980s, CompuServe's public data network offers many services on a national and worldwide basis.

Our description of the company's services begins with Fixed-Dial, Usage-Dial, Private-Dial, and Open Port Arrangement. These CompuServe dial-up access services are available at connection speeds of 300 to 9,600 bps.

Fixed-Dial is an asynchronous service that is priced on a flat hourly rate. Its pricing scheme works on a sliding scale. If you access the service from 0 to 750 hours per month, for example, the per-hour rate is \$5.75; on the other hand, climb to 2,501 to 4,000 hours per month, and the price drops to \$4.40 per hour. Rates for Usage-Dial, another asynchronous dial-up access, are based on both connect time and kilocharacter transmission.

Private-Dial allows you to have dedicated asynchronous network access ports for a flat fee of \$350 per port per month after an installation fee. The price of each private port includes a dial-up phone line and a modem at your network's CompuServe access node; with a private access port, you can overcome the potential delays that may occur at the point at which your line goes into the PDN.

Offering a unique pricing plan among the services included in this roundup, Open Port Arrangement offers a fixed-rate access per simultaneous user (minimum five users), rather than by connect time, of a customer's host computer through the CompuServe network.

DEDICATED ACCESS

CompuServe's Dedicated Access services consist of both Fixed-X.25 and Private-Async services. As the name implies, Fixed-X.25 is a leased-line type of service; it is based on a fixed monthly rate depending on the speed you choose (from 9.6 to 56 Kbps) and the number of user channels per location (8, 16, or 32). You're

CONNECTIVITY PUBLIC DATA NETWORKS

also billed \$0.02 per kilocharacter for usage.

The other CompuServe Dedicated Access service, Private-Async, allows for asynchronous network access ports dedicated to CompuServe access nodes. This service includes a leased line and two modems: one for the network access node and another for the customer site itself. Service is available at speeds from 300 to 9,600 bps and is billed at a monthly rate of \$350 per port per month, plus an installation fee.

Private-Async is comparable to the company's Private-Dial, described earlier. The difference between the two lies not in speed but in using Private-Async's private port over a leased line, as opposed to using Private-Dial's dial-up line. Overall, because of its flat-rate pricing, this type of connection would be appropriate

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CompuServe Information

Service is a familiar
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many a PC user; its

PDN offers services on
a world-wide basis.

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for a router or bridge on a LAN segment at a national headquarters, particularly if the regional and local offices need frequent access to the headquarters' LAN. Note, however, that the connection between the X.25 network and the bridge or router is asynchronous and thus receives no X.25-protocol error correction at this leg of its journey.

The newest of the company's services is Fixed-LAN, which is basically an extension of Fixed-X.25 for customers who require a complete end-to-end solution. Available for 8, 16, or 32 simultaneous users per line at speeds of 9.6 to 56 Kbps (the same as available for Fixed-X.25), this package adds on a workstation PC fitted with the necessary Eicon Technology gateway and router, plus a leased line



FACT FILE

CompuServe Network Services

CompuServe Inc., 5000 Arlington Centre Blvd., Columbus, OH 43220; 800-848-8199, 614-457-8600.

Price: Varies.

In Short: Best known for its Information Service, CompuServe also markets a broad range of PDN services on a national and worldwide basis. These include dial-up and dedicated access services plus the new high-speed Fixed-LAN service, which uses Eicon Technology's popular gateway and router products.

CIRCLE 427 ON READER SERVICE CARD

to the PDN. The entire package is installed and maintained by CompuServe as part of the fixed monthly charge, which, because of the included products and extra service, is higher than that of its Fixed-X.25 service.

The third class of CompuServe's PDN services, X.25 Host Interface Services, provides a dedicated access that connects host computers—any PCs that originate X.25 packets—to the CompuServe network. Your host computer, bridge, or router to the CompuServe network is connected via an X.25 circuit directly into your facility. Included in the monthly charge, beyond installation fees, are the dedicated X.25 connection into the PDN, a leased line from your site to the designated CompuServe access node, and the required modems/DSUs. The cost also depends on the speed you choose, from 9.6 to 56 Kbps.

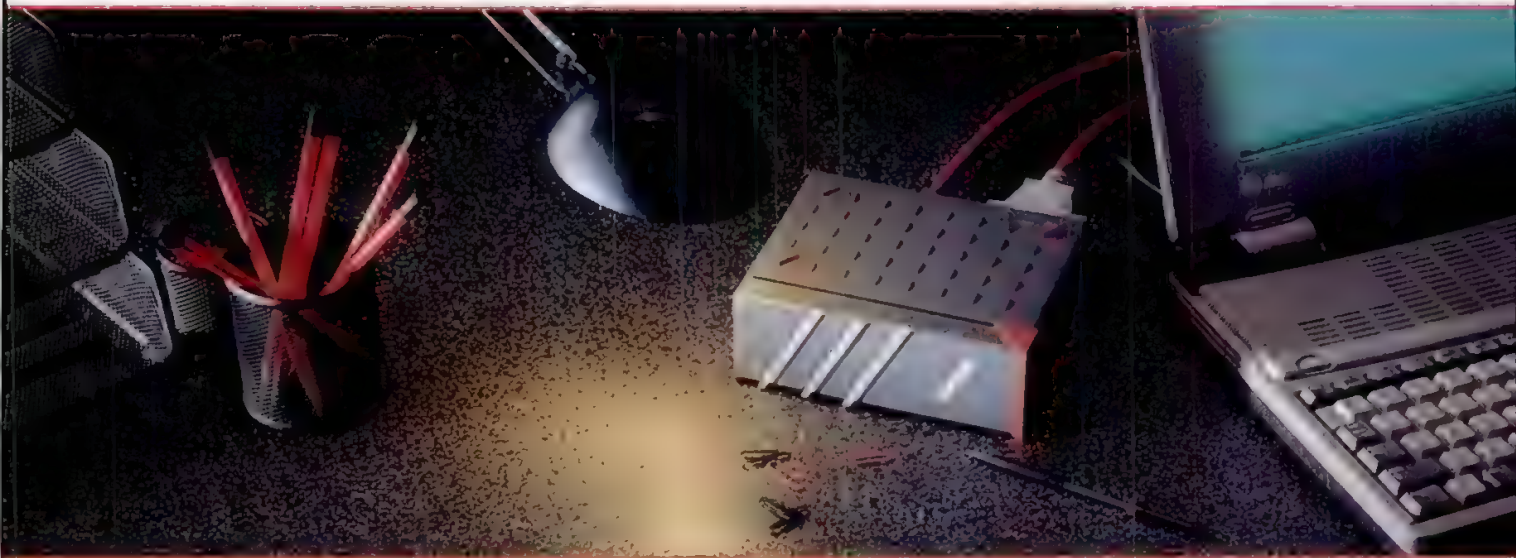
USAGE SCENARIO

For the two alternatives we received regarding our LAN-to-LAN PDN usage scenario, CompuServe formulated its pricing under the assumption that the 9.6-Kbps sites would have 16 simultaneous users per line and the 56-Kbps site would operate with 32 users. The length of the customer's commitment is assumed to be two years. CompuServe's normal pricing structure is based upon five or more sites, and the first two sites would normally be priced at a higher rate.

In early 1992, CompuServe plans to release Frame-Net, a public frame relay service, to supplement its already existing X.25 packet-switching network. The company has chosen StrataCom's fast-packet IPX T1 network systems for its frame relay platform.

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DATAPAC: A Look at Canada's National X.25 Carrier

by Sara Parker

Our roundup of PDNs includes services accessible from within the United States and in many other countries on a worldwide basis. One service based nearby, however, is a PDN all its own. More importantly, it is the result of a joint venture entered into for the good of a nation's business.

Telecom Canada's Datapac stands apart from the other PDN services reviewed here in several respects. First, it is a Canada-based organization. Second, it is not an incorporated business but rather an association of Canada's ten major telecommunications companies. Telecom Canada earns no income for itself; nevertheless, it provides 24-hour-a-day service (solely) to Canadian businesses.

Datapac services are available in more than 200 locations in Canada. They are also interconnected with eight packet-switching networks in the United States. Through Teleglobe, an overseas carrier, Datapac achieves worldwide connectivity in 96 countries. For information about the association's services, contact the Datapac Customer Assistance Center.

A VARIETY OF SERVICES

Telecom Canada's main X.25 Service, Datapac 3000, is a dedicated access service providing support for synchronous communications lines typically run from a company's primary network, often mainframe-based. Supporting speeds of 1.2, 2.4, 4.8, 9.6, 19.2, and 56 Kbps, the service offers public dial-up access (using a PAD at the customer's end) at 2.4 Kbps.

A related Datapac service, Datapac 3101, is intended for lower-volume access using asynchronous connections. This service's dedicated or dial-in lines can transfer data at speeds ranging from 110 to 2,400 bps. Other services include the Datapac 3201, which provides X.25 or asynchronous access for point-of-sale (POS) terminals, and Datapac 3303/SDLC. The latter operates at speeds of 2.4, 4.8, or 9.6 bps and

allows remote 3270-family and related terminals using the SDLC protocol to access a host network via a PAD located at the public data network.

Datapac's rate structure is based on the city of origin in the Datapac service area and the distance between the originating and terminating points of transmission. The access charge is currently the same for all areas. For example, for Datapac's X.25 access, the access charge at 9.6 Kbps is \$465 per month, which includes the charge for accessing the network via a local exchange carrier. The service charge for connection is \$500. The local rate is \$0.42 per kilopacket, and—depending on the distance being connected and the city—the rates range from \$0.40 to \$7. (Since you can access the Datapac network only from within Canada, all prices are in Canadian dollars.)

Datapac, however, is undergoing a rate restructuring. With the approval of the Canadian Radio and Telephone Telecommunications Commission, the association's pricing will be based solely on the distance between the origin and destination of the data transmission. The access charge will depend on whether a city is a high- or low-density area; the latter will be the more expensive. With the restructured rates for 9.6-Kbps access, for example, the access charge will remain \$465 for the high-density area but the new rates will range from \$0.42 to \$1.95, again depending on the distance.

Datapac estimates that with the implementation of its new rate structure, 70 percent of its users will see cost reductions while 30 percent will see, at most, an increase of 5 percent.

Datapac

Telecom Canada, 160 Elgin St., Rm. 1080, Ottawa, Ontario K1G 3J4 Canada; 613-781-6798.

Price: All prices based on service chosen, network access method, transmission speeds, data traffic, and other factors determined on a customer-by-customer basis.

CIRCLE 425 ON READER SERVICE CARD

IBM CORP. IBM Information Network

IBM has long been recognized for implementing fully integrated networking solutions across a wide variety of hardware platforms. With the IBM Information Network, the company offers networking answers to organizations looking for complete solutions to LAN-to-LAN communications or for ways of linking PCs to mainframes.

The IBM Information Network (IN) is an international PDN that offers services ranging from networking and messaging systems to database access and e-mail. All its services are accessible across the full line of IBM hardware and software, as well as many non-IBM products.

IBM IN services are arranged through leased-line connections in more than 50 U.S. cities or via 800-number dial-in connectivity from virtually anywhere in the United States. International service is also available in more than 80 countries.

X.25 SUPPORT

The company's X.25 support, called Network Services in support of X.25, offers data transmission speeds from 9.6 to 56 Kbps. The package includes a dedicated leased line between the user's site and IBM Information Network, modems for both locations, and an IBM IN communications controller port—a dedicated access port, in other words—that enables access to the company's network.

IBM's X.25 service rates include a monthly carrier charge (dependent on the speed you select), an hourly usage charge rate, and an installation fee. The monthly



IBM Information Network

IBM Corp., 3405 W. Dr. Martin Luther King Jr. Blvd., Tampa, FL 33607; 800-727-2222, 813-878-3000.

Price: Varies.

In Short: The IBM Information Network offers a range of services that are accessible across the gamut of IBM and IBM-compatible hardware and software. International service is available. In the United States, services are arranged through leased-line connections in more than 50 cities or via 800-number dial-in connectivity.

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rates range from \$1,050 at 9.6 Kbps to \$4,200 at 56 Kbps. These monthly charges include all network traffic as well as the leased line port.

USAGE SCENARIO

Usage charges for IBM IN are divided into two categories: a \$3.70 per-hour rate per session for prime-time usage (from 8:00 A.M. to 8:00 P.M. E.S.T., Monday through Friday), and a \$1.85 per-hour rate per session for non-prime-time usage. IBM's X.25 installation charge is a one-time fee of \$998.

IBM was unwilling to commit to a monthly fee for our LAN-to-LAN usage scenario. Its network solutions, like those of other PDNs described here, are tailored to customers' needs and system configurations and vary widely from customer to customer.

INFONET SERVICES CORP.

Infonet

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Infonet Services Corp. has seen some changes in its 20 years of providing computing services. A division of Computer Sciences Corp. (CSC) until the late 1980s, its staff developed worldwide X.25 packet-switching networks for the U.S. federal government. Today, MCI owns 25 percent of Infontet. Ten overseas Postal, Telegraph & Telephone (PTT) companies—including those of Germany, France, and Japan—jointly own the remaining 75 percent.

As its ownership might indicate, most of Infontet's business is international. Its customers, in fact, consist largely of multinational corporations accessing the Infontet network services from within 111 countries.

With its speed range of 9.6 to 64 Kbps, Infontet's X.25 Network Service is intended for frequent, high-volume transmission. Billing is at a fixed monthly price; it includes all usage and a leased line between the user's LAN and the nearest Infontet access node.

Infonet Services Corp. also has many management services that it offers under the auspices of the Enterprise Defined Network Services (EDNS). If a private global network, for example, becomes too large for a client company to manage, Infontet will take over the network management for the client company and will undertake any expansion if and when it

should become necessary.

Infonet also offers EDNS help for company networks heading in the opposite direction: a fully managed global network for current Infontet customers who get too big for public services and decide to implement their own private network. Both of the above services are priced on a per-client basis.

USAGE SCENARIO

Based upon information presented to Infontet for our LAN-to-LAN usage scenario, the pricing that Infontet presented for its X.25 Network Service is \$3,525 per month, with no additional charge for data volume. This price assumes that the customer will procure modems/DSUs and dial-up access via a local exchange carrier, though Infontet can supply them.

A newly released service from Infontet, Infolan, is an end-to-end LAN connectivity service. Released in June 1991, Infolan offers speeds ranging from 9.6 Kbps to 1.544 Mbps in the United States. LANS communicate not through the X.25 protocol but rather by using native LAN/WAN protocols such as TCP/IP and Source Route Bridging.

Infonet offers two Infolan solutions based on existing equipment at the target sites. The first package includes a network port, in-country circuit with modems/DSUs, and an unlimited volume of data. The second option is aimed at customers who will require a router at their site for LAN connection to the PDN. Under this option, Infontet leases the router along with the bundled package.

Pricing for either Infolan solution is based upon a fixed monthly rate—again, with no additional charge for data vol-

ume. It varies according to a number of factors particular to each customer, such as the number of locations, domestic versus international service, connection speed, the distance from the nearest Infontet node, and regional versus global communications.

GENERAL ELECTRIC CORP.

Mark*Net

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GE's Information Services Division, founded in 1964, achieves worldwide connectivity through its Mark*Net public data network. X.25 services under the Mark*Net umbrella include both asynchronous and synchronous transmission.

While GE Information Services currently offers X.25 technology to connect LANs through packet switching, the company has begun to focus more heavily on customized solutions. By incorporating the StrataCom IPX Fast Packet T1 Multiplexer into its network, GE Information Services hopes to offer frame relay and faster X.25 service to end users by the end of 1991.

ASYNCH VS. SYNC

The various services in GE's Mark*Net network go under the general umbrella title of Managed Network Services. Asynchronous support is available through either PADs owned and operated by GE within the company's network or via PADs located at the user's site. Whichever series of PADs you choose, it can be leased through GE Information Services as part of its network solution. Asynchronous access is available in more than 750 cities worldwide through both asynchronous dial-up and leased lines at speeds ranging from 300 to 9,600 bps.

X.25 synchronous support is available worldwide for users who require greater throughput than is available through asynchronous connections. Using leased lines and ports available at 24 locations, the service operates at transmission speeds ranging from 4.8 to 64 Kbps.

GE Information Services is readying the late-1991 release of a new Dial X.25 service in which two pricing options will be available. The first is set according to usage. The second option is based on unlimited kilocharacter usage and is simply a flat monthly rate. Slated to offer connect speeds of 2.4, 4.8, and 9.6 Kbps, Dial X.25 is expected to be fully operational



FACT FILE

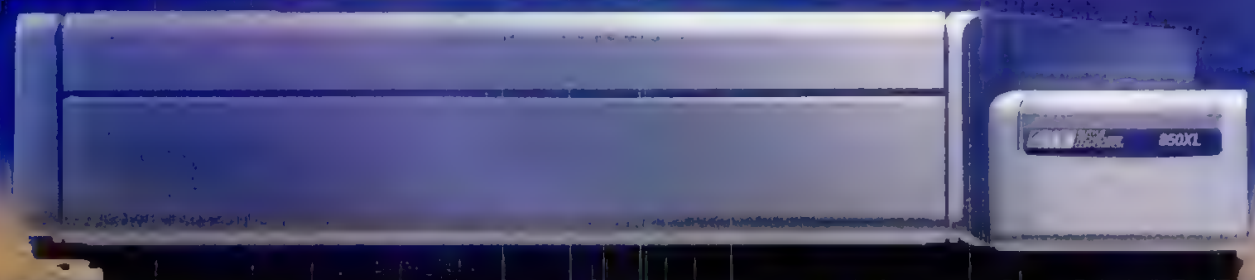
Infonet

Infonet Services Corp., 2100 East Grand Ave., El Segundo, CA 90245; 800-342-5272, 213-335-2600.

Price: Varies.

In Short: Designed to deal mostly with international business, Infontet's X.25 Network Service is intended for high-volume transmission. The availability of network management services are a plus in the marketplace.

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CIRCLE 245 ON READER SERVICE CARD



FACT FILE

Mark*Net

General Electric Corp., Information Services Division, 401 N. Washington St., Rockville, MD 20850; 800 433-3683, 301-251-6510.

Price: Varies.

In Short: GE's Mark*Net services have a number of options for both synchronous and asynchronous network access. The company also expects to offer both enhanced X.25 and frame relay service to users by the end of the year.

CIRCLE 542 ON READER SERVICE CARD

by December 1991.

For our LAN-to-LAN usage scenario, GE Information Services recommends one of its Mark*Net services, the X.25 bi-directional virtual circuit service. The Dallas branch would be a prime candidate for GE's new Dial X.25 service because of its low-volume traffic. Because GE Information Services prices its services depending on the customized service determined after a review of each customer's needs, the company declined to release pricing information.

U.S. SPRINT COMMUNICATIONS CO.**SprintNet Data Network**

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When you hear the name *Sprint*, the company's long-distance telephone service immediately comes to mind. What many people don't realize is that SprintNet Data Network, a U.S. Sprint service, currently has a very large share of the public data network market in the United States and abroad.

U.S. Sprint gains its strength in the PDN arena through a variety of sources. Telenet Communications Corp., founded in 1972 to develop packet-switching technology, was acquired by GTE Corp. in 1979. In 1986, GTE Corp. and United Telecommunications Corp. merged to become U.S. Sprint. As a result the two PDNs, Uninet and Telenet, were merged together. Finally, in 1990 Telenet as a subsidiary was fully absorbed into U.S. Sprint and no longer exists as the public data network Telenet. It is now known as SprintNet.

Today's SprintNet Data Network offers services that include both Dedicated Access Facilities and Dial Access Services, with options for each category. These

services are available in the United States as well as overseas. International service is priced per country, and you can access it through U.S. Sprint nodes as well as through individual local data networks connected to U.S. Sprint.

SprintNet's LAN Reach X.25 service is appropriate for users with a high enough volume of data to require reasonably high transmission speeds at a fixed price—but not such a high volume that the service's dial-up line would pose a problem. Depending upon speed and type of access, LAN Reach X.25 is priced from a fixed monthly fee of \$800 per site per month at 9.6 Kbps to \$1,200 per month per site at 19.2 Kbps. An additional option is a private-access dial-up line. Higher speeds are also available; costs are determined on a per-customer basis.

USAGE SCENARIO

For our LAN-to-LAN scenario, U.S. Sprint suggested the use of LAN Reach X.25 service to connect each of the four sites. Remote dial-in from any of the three branches could be accomplished through the use of either asynchronous dial-up or X.25 dial-up services. The price for these SprintNet services would total between \$4,000 and \$4,700 per month, depending on transmission speed and whether asynchronous or X.25 dial-up is used. (The price for the LAN Reach service at the New York office at the speed of 56 Kbps is higher than those quoted in the preceding paragraph; this is reflected in the monthly total as it is figured here.) The high prices for X.25 dial-up include an Eicon Technology gateway card and accompanying software; asynchronous dial-up uses the customer's own modem and communications software.

SprintNet's Dial Access Services also give you the option of asynchronous dial-up or X.25 service but at lower speeds than you'll get from LAN Reach. Pricing is not fixed but is based on an hourly charge. The pricing for both SprintNet's asynchronous (at 300 to 9,600 bps) and X.25 (1.2 to 9.6 Kbps) service depends on the level of usage from your particular calling area.

The company's Dedicated Access Facilities are basically what the name implies: services that include a leased line between the customer site and the access center, a leased channel port, and the required modems. Asynchronous service



FACT FILE

SprintNet Data Network

U.S. Sprint Communications Co., 12490 Sunrise Valley Dr., Reston, VA 22096; 800-736-1130, 703 689-6000.

Price: Varies.

In Short: SprintNet has acquired wide experience with and extensive knowledge of multiple data network sources (Telenet among them) through the many corporate mergers that created the PDN. Currently, it offers services like the new LAN Reach X.25 and plans to release a frame relay service in the third quarter.

CIRCLE 543 ON READER SERVICE CARD

ranges from 300 to 1,200 bps and incurs a monthly charge of \$600 plus an installation fee of \$1,200. The X.25 DAF service also incurs a monthly charge and a fixed installment charge depending upon the chosen speed of service, with speeds ranging from 2.4 to 56 Kbps.

SprintNet is planning for the imminent release of its frame relay service, expected to be operational sometime in the third quarter of this year. Frame relay will complement SprintNet's existing X.25 data network service.

BT NORTH AMERICA INC.**Tymnet Global Network**

.....

Value-added network services and European expansion are high on BT North America's priority list. It makes sense: BT stands for British Telecom, which bought Tymnet from McDonnell Douglas in November 1989 and today operates the PDN as Tymnet Global Network. Tymnet today has 4,500 nodes worldwide—1,000 of them outside of the United States—in more than 100 countries.

One of the ways that Tymnet provides LAN connectivity is through XLINK Express, Tymnet's standard X.25 service. XLINK is a software package that is made up of nine services. These support between 8 and 64 simultaneous users at speeds ranging from 2.4 to 19.2 Kbps. Pricing is based on a monthly fee depending on the supported speed plus the applicable installation fee; the rate is \$650 per month at 2.4 Kbps and \$1,600 per month at 19.2 Kbps.

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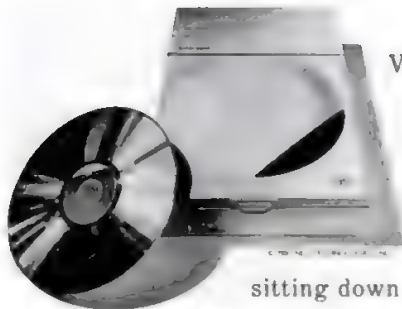


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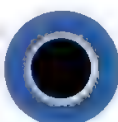
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A close-up of a VHS tape. The spine is decorated with vertical stripes of rainbow colors (red, orange, yellow, green, blue, purple). The words "FACT FILE" are printed in large, white, block letters across the top of the spine. The tape is partially inserted into its clear plastic case.

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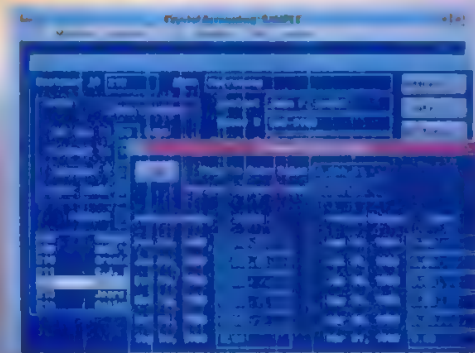
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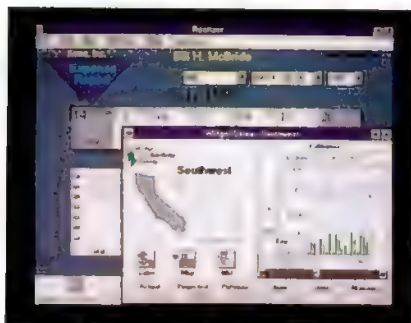
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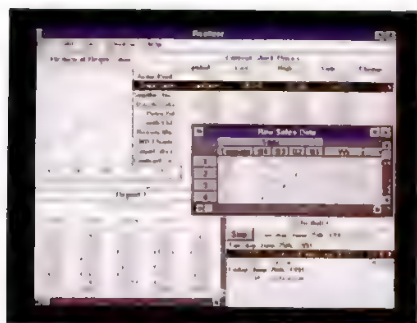
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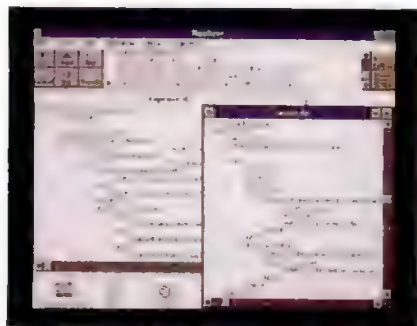
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by
Barry Simon

Lab Notes

What You Can Do to Overcome Disk Disasters, Part 1

I bailed out the moment the program I was reviewing started behaving erratically, but it was too late. Instead of exiting smoothly to the DOS prompt, I'd crashed so hard not even a three-finger salute would work. Worse yet, when I hit the reset button, instead of the usual bootup beep, up came the message: SYSTEM HALTED NO ROM BASIC. Whether through hardware failure or software corruption, I suddenly had 600 megs of dead hard drive.

Like any reasonable computer user, I panicked. My life—or at least all the files I'd made since my last backup—passed before my eyes. When Reason returned and I put in a DOS floppy, however, at least it booted up. But entering C: brought only the message, "Invalid drive specification." Was everything on the drive gone for good?

The next step was to run FDISK; if FDISK could still recognize the drive, at least it wasn't totally shot. And as long as you're careful not to tell FDISK to remove or set up a new partition, it won't hurt anything. I ran FDISK and it offered to set up partitions on Drive 0. I could breathe easier—"only" my partition table had been overwritten.

Had this happened three years ago, I'd have known the problem but had no real solution for it. I'd have fumed and wept, but all I could have done would have been to run FDISK, FORMAT, and RESTORE, thereby losing all my work since the last time I had backed up my files.

Since then, however, there's been remarkable progress in disk recovery utilities, so I reached for *The Norton Utilities* on my shelf—at the time, Version 4.5. I ran NDD, the Norton *Disk Doctor*. No luck: I've got a SCSI disk whose type doesn't appear in the BIOS table and *Norton*, noticing this, refused to load. Time to try *PC Tools'* *DiskFix* program instead. Success! It confirmed that I had a damaged partition table and offered to restore it. I gratefully answered yes, exited and rebooted. The reboot started fine, and I began to grin—until I got invalid drive error messages. *PC Tools* had restored only par-

■ Damage to a disk's logical structure is the most common cause of disk disasters. Understanding this logical structure is vital—even with today's sophisticated file-recovery tools.

tition C:, and my disk had had three partitions. Time for *The Mace Utilities'* ER, the Emergency Room, which recovered the rest of the partition table.

UNDERSTANDING THE TOOLS

The point of this story is not *which* of these programs worked in my situation; that might have varied with a different problem and different hardware. The point is rather to emphasize that there *are* powerful tools available today that can help you overcome even catastrophic problems with disks and files. In their current versions, the "Big Three" file recovery utilities (*The Norton Utilities* 5.0, *The Mace Utilities* 1990, and *PC Tools Deluxe*) all offer an extraordinary range of largely overlapping capabilities. I won't be reviewing these sets of tools here; rather, I'll try to give you an understanding of *how* they can do what they do.

The key to using these tools intelligently is understanding the logical structure of the disk on which they work. Damage to the logical structure of the disk is the most common cause of disk disasters, so I'll concentrate on that. But before you settle on such a diagnosis when you encounter a

disk problem, there are at least two other possibilities you should keep in mind.

First, remember that the hardware itself *can* go bad. Fortunately, this will almost always produce a message to the effect that DOS thinks there is a hardware error. Such a message may mention read errors or address mark not found.

Hardware failure is often sudden: You turn on your computer, and after it goes through POST (Power On Self Test), without warning you get a four-digit error number beginning with 17—a hard disk error. If the failure process is more gradual, you can try to protect your data by locking out bad sectors with a program like *Norton's* Disk Test or you can even try a nondestructive low-level format refresh program like Gibson Research's *SpinRite* or *Norton's* *Disk Doctor*.

Note that almost all large hard disks have *some* bad sectors that date back to the time of their manufacture. This is normal, and part of the formatting job is to lock these sectors out. It's when you start losing *additional* sectors during normal use that you should conclude that your disk's days are numbered. Get its affairs in order with backups and prepare to administer its last rites.

A second possibility is a virus. Given the level of hysteria on this subject today, this may be the first thing you think of. If so, you're probably overreacting; however, common prudence certainly dictates keeping a scan program on hand to check for viruses.

FORMATTING: AN OVERVIEW

It's well to begin thinking about problems with a disk's logical structure by consider-

Lab Notes

ing the formatting process that imposes it. Before you can read from or write to a disk, it must be *formatted*. Formatting a hard disk or a diskette involves two distinct steps: (1) *low-level* (a.k.a. hard or physical) formatting; and (2) *high-level* (a.k.a. logical or DOS) formatting. The DOS FORMAT command executes both procedures on floppy disks. On hard disks, FORMAT performs only high-level formatting; low-level hard disk formatting is done by the manufacturer or with programs such as *Disk Manager*.

During the low-level formatting process, all DOS disks are divided into addressable 512-byte units called *sectors*. (Some third-party partitioning software allows larger sectors, and VDISK and some other RAM disks allow smaller sizes.) When disk controllers read or write data, they think of one sector at a time.

Sectors are magnetically laid down one after another in concentric circles known as *tracks*. The separate tracks that contain the sectors are closely spaced from the outer to the inner diameter of the disk. On a 360K floppy disk there are 9 sectors per track; on a typical hard disk there may be 17, and very high capacity hard disks that use advanced encoding techniques may cram 63 sectors end-to-end around a single track.

Tracks that share the same radius and spindle (there are at least two, since each platter has two sides) can be visualized as forming concentric *cylinders*.

The high-level formatting of a diskette or hard disk partition establishes the logical structure of the disk by distributing the sectors between a *system area* (at the outside, or beginning of the disk) and a *data area* (the remainder of the disk, where your files reside). The system area of a formatted floppy and a DOS partition on a hard disk comprise three components: the *boot sector*, the *file allocation table* (FAT), and the *root directory*.

Before you use FORMAT on a hard disk, however, you may recall having had to run FDISK. FDISK lays down a *master boot sector*—the very first sector on side 0, track 0 of the disk. This sector contains a short *master boot program*, immediately followed by the *partition table*. On a system with one hard disk and several DOS partitions, DOS can't find the start of drive D: unless it has the information in the parti-

tion table that lets it figure out how big drive C: is. The partition table also specifies which is the "active," or bootable, partition.

It's important to note that while FDISK lets you specify one partition as the active one, it doesn't insist that you do so. I still remember one very embarrassing incident from my past: I got a machine that had been shipped with a single 600MB partition. Since I preferred to have three equal pieces, I used FDISK and FORMAT to set it up that way. However when I attempted to boot from the hard disk, I wound up with a NO ROM BASIC message. It turned out that I'd forgotten to set *any* partition to active status!

The idea of allowing a hard disk to contain multiple partitions was originally conceived to accommodate several operating systems (for example, DOS and Xenix) on one machine. But in DOS 3.3 it quickly came to be used principally as a makeshift way of handling disks larger than 32MB. Since each partition is a separate logical entity, by putting several DOS partitions on the same disk, DOS could gain access to more than 32MB stored on the same physical drive.

The 32MB "barrier" of DOS 3.x is a result of the fact that the number of controllable sectors is stored in a 2-byte (16-bit) word. The number of 1s and 0s that can be expressed in 16 bits is 2^{16} , or 65,536.

Multiply 64K by 512 bytes per sector, and you get 32MB. Even after DOS 4.0 broke the 32MB barrier, many users have found that they prefer to have multiple DOS partitions to keep their disks organized. Each record in the partition table is 16 bytes, including 4 each for the starting sector and the number of sectors. In addition, one byte is reserved for the partition *type*. The most common values for this byte are shown below:

00	An unused partition
01	DOS with 12-bit FAT
02	Xenix
03	Xenix
04	DOS with 16-bit FAT
05	Extended DOS partition
06	Compaq DOS 3.31, 4.0, 4.1 and 5.0 > 32MB partition
07	OS/2 HPFS partition
75	PC/IX
DB	CP/M
FF	Xenix bad block table

There is enough room for only four 16-

byte partition records in the partition table. How is it, then, that someone can have a 320MB hard disk that has ten 32MB partitions? The key to this setup is the partition type called Extended DOS partition, which has a pointer to a table on-disk for multiple logical volumes. The ten-partition disk really uses only two entries in the partition table, one DOS with 16-bit FAT and one Extended DOS partition whose on-disk table sets up nine logical volumes.

THE PARTITION BOOT SECTOR

In sequence then, the BIOS loads and runs the master boot program, consulting the partition table to determine the location of the active partition. When it gets to the active partition, it loads the boot sector for that partition into memory and passes control to it.

As the name implies, the boot sector of a diskette or a hard disk partition is a sector of data that contains a brief program run when the system is booted. If you've transferred DOS to the disk with FORMAT /S or the SYS command, the hidden system file IBMBIO.COM (or IO.SYS on some versions of MS-DOS) will be found (it must be the first file in the disk's data area) and control passes to it. When you format a disk without transferring the system, the disk, of course, is not bootable. When you try to boot with such a disk, a program that displays the error message "Non-System disk or disk error Replace and strike any key when ready" is written to the disk. The program waits for you to press a key and then reads in the boot sector of the new disk. The SYS command actually removes this error message and replaces that program with one that reads in the system files.

Although called the *boot sector*, this first portion of the system area of a DOS disk or partition is used not only when booting up, but every time the disk is accessed. That's because the sector contains a data area that holds critical information on sector size and on the physical structure of the disk. I once got a diskette from a vendor that caused my system to crash if I so much as put it in drive A: and entered DIR A:. This behavior was sufficiently bizarre as to call for investigation, which revealed that the problem with this death disk was that it was headless. That is to say, the byte in boot sector data area that's supposed to indicate the number of heads on the disk (diskettes have two heads; hard disks with multiple platters have more than two) was set to 0. Errors in the boot sector

Lab Notes

can thus have dramatic consequences, even if you aren't trying to use the disk as a boot disk!

The boot sector data area also contains an OEM ID (IBM if DOS formatted the disk, or either NO NAME or a company name if it was formatted with MS-DOS). Here is the information in the boot sector data area:

OFFSET	DESCRIPTION
3-10	System ID
11-12	bytes/sector
13	sectors/cluster
14-15	sectors prior to data area
16	number of copies of FAT
17-18	no. of entries in root dir
19-20	total number of sectors **
21	DOS media descriptor
22-23	number of sectors per FAT
24-25	number of sectors per track
26-27	number of heads
27-28	number of hidden sectors

This list is accurate for disks formatted with DOS 3; five additional fields were added in DOS 4.0.

As noted earlier, DOS 4.0 lets you create drives larger than 32MB. For such drives, the sector total will exceed 64K. Bytes 19 to 20 will have zeros and you'd check DOS 4.0's additional fields for the correct sector count.

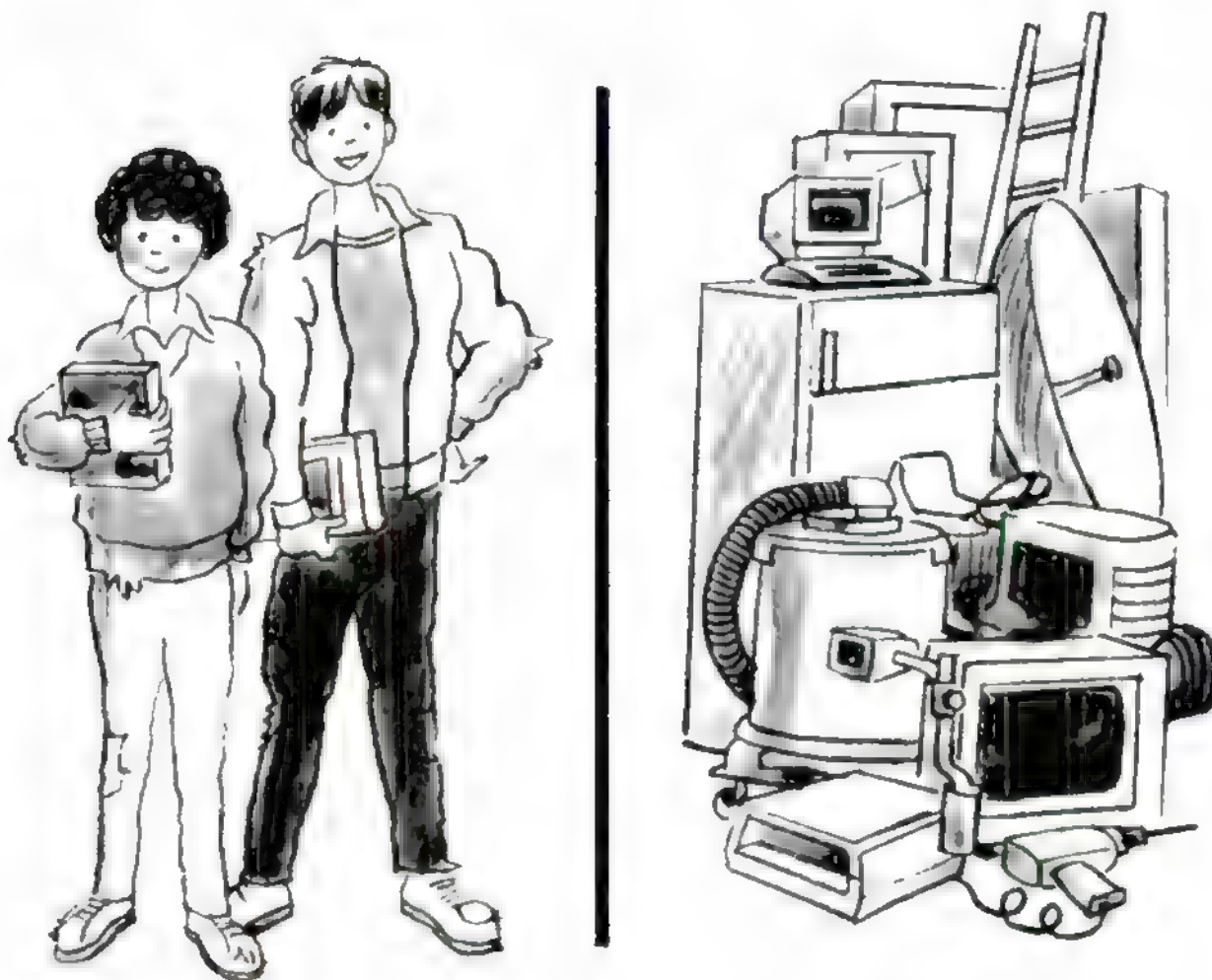
The values, in hexadecimal, for the media ID (byte 21) are

160 KB disk (5.25")	FEh
320 KB disk (5.25")	FFh
180 KB disk (5.25")	FCh
360 KB disk (5.25")	FDh
1.2 MB disk (5.25")	F9h
720 KB disk (3.5")	F9h
1.44 MB disk (3.5")	F0h
hard disk	F8h

Note that two different disks have F9h as their value.

For a quick look at the information contained in the boot sector of any disk, you can download the program READBOOT.EXE from PC MagNet. (Instructions on how to do this can be found on the PC MagNet page, which immediately follows the Utilities column.) Entered with no parameters, READBOOT reads and decodes the boot sector of the default drive, but you can supply a drive letter (with or without

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the usual colon) to direct its attention elsewhere. The Turbo Pascal source code for READBOOT.EXE can also be downloaded from PC MagNet.

THE FILE ALLOCATION TABLE (FAT)

The second part of the system area of the disk, immediately following the boot sector, is the file allocation table, or FAT. In contrast to the boot sector, the FAT can occupy many sectors. Indeed, two copies of the FAT are kept on-disk, though DOS itself makes no use of the second copy. Why the second copy, then? That's unclear, although one can conjecture that the designers of DOS had plans for a method—never implemented in DOS—for accessing the second copy if the first became corrupted. Having been specified originally, however, the second copy was kept thereafter for compatibility. File recovery programs such as those supplied with *Mace*, *Norton*, and *PC Tools* can make use of this second copy.

The FAT is essentially a database with

a fixed-length record for the number of each *cluster* in the general data area of the disk where your files themselves are kept. A cluster is simply a group of one or more sectors that DOS allocates as a single unit. Cluster size, which is always a power of two, is fixed for a given diskette or partition. It is 1K (two sectors) on 360K and 720K diskettes, 512 bytes on 1.2MB and 1.44MB diskettes, and most commonly 2K (four sectors) on hard disks formatted with DOS 3.x and later.

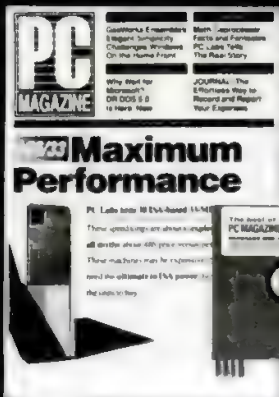
On diskettes and hard disks formatted with DOS 2.x, the record length for a FAT or directory entry is limited to 12 bits—that is, to a byte and a half. The failure to work in whole bytes complicates the code manipulating the FAT and is a hold-over from the original 160K one-sided diskettes, where every bit saved was important. Worse than the inconvenience, however, is that with 12 bits, only 4,096 numberable areas on the disk can be addressed. If the cluster size were set at one sector (512 bytes), this would mean that a hard disk partition could not exceed 2MB in storage capacity! Using four-sector clusters (2K) still raises the maximum size to only 8MB. Under the 12-bit FAT (and di-

rectory) record length of DOS 2.x disk partitions larger than 8MB required using 4K (eight-sector) clusters. Since, on average, half a cluster lies fallow when a file is written to it, further increases in cluster size waste a considerable amount of valuable disk space.

DOS 3.x upped the record size for FAT and directory entries to 2 bytes—16 bits. 12-bit FAT records could still be used where sufficient, but 16-bit records became available. This made the number of addressable clusters and absolute sectors the same: 65,536. Whereas under DOS 2.x the limitation on disk partition size was set by the number of addressable clusters, since DOS *also* needs to communicate with the disk controller in terms of sector numbers, the latter became the limiting factor under DOS 3.x.

The potential capacity of the FAT and directory entries (128MB, using conventional four-sector, 2K clusters) can be realized only with DOS 4.x and 5.x, where the number of absolute sectors has been raised to 4 billion. The first two records in the FAT—that is, the first 3 bytes for a 12-bit FAT and the first 4 bytes for a 16-bit FAT—are an ID for the FAT itself. Cur-

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rently, the first byte in the FAT ID is the same as the media descriptor byte, and the other 2 or 3 bytes are set to FFh. Since records 0 and 1 are taken by the FAT ID and it is desirable to have cluster numbers correspond precisely to offsets in the file allocation table, the numbering of the clusters in the data area of the disk begins with 2.

Except for the specific values listed below, the number that constitutes an entry in the file allocation table is the number of the *next* cluster used by a given file. (The number of the *first* cluster assigned to a file is contained in its directory entry, which I'll discuss shortly.) The special values that can occur in a 16-bit FAT are

VALUE	DESCRIPTION
0	Unused (free) cluster
FFF0-FFF6h	reserved
FFF7h	bad cluster (marked during format)
FFF8-FFFFh	last cluster in a file

Twelve-bit FATs simply omit the initial F in the hex numbers shown above.

By way of example, if a file has only one assigned cluster, say cluster 534, then the corresponding FAT entry will hold the special value FFFF. (Although values FFF8h through FFFFh are allowed, in my experience it is FFFF that is actually used.)

Otherwise, the FAT entry will be the number of the *next* cluster associated with a file. In this way, the chain of clusters that holds the file in the general data area of the disk is indicated by successive entries in the FAT. When the chain ends, the FAT entry is FFFFh or FFFh.

HOW FILE SPACE IS ALLOCATED

When a program makes a request to increase the size of a file so that more than the number of currently assigned clusters is needed, all that DOS does is find a free cluster, copy the new data there, change the FAT entry for the previous last cluster to the number of the newly assigned cluster, and change the FAT entry for the new cluster to indicate that it is now the last cluster in the chain.

If a file is expanded and the available free clusters on a disk are scattered, invariably its assigned clusters wind up spread out in different places on the disk. Such a file is called *fragmented*. DOS can keep track of it without any problem, but the

disk head now has to jump around the disk to read the file, so performance suffers.

A defragmenting utility (supplied with each of the major disk recovery programs) rearranges the physical locations of the file to make the file clusters contiguous and correspondingly updates the FAT. As one of the few kinds of programs that directly manipulate the FAT, a defragmenter is clearly a program that could have disastrous consequences if it fouls up. Since TSRs, in my opinion, invariably make your PC environment more crash-prone, and could also attempt to access a file while it was being moved or keep open a file after a move, there's a good reason to follow the advice invariably given with de-

As one of the few kinds
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fouls up.

fragmenting utilities: Run them without any TSRs loaded.

So that you can see the clusters actually assigned to your files even if you haven't yet purchased one of the recovery utility packages, I've written another Turbo Pascal program called PCMFAT.EXE. This also can be downloaded with source code from PC MagNet. The program requires that the file to be displayed be in your current directory. Thus, if you keep PCMFAT in your D:\UTIL directory and want to examine COMMAND.COM, you go to the C: prompt and enter

```
D:\UTIL\PCMFAT COMMAND.COM
```

As its source code shows, PCMFAT gets the starting cluster from the raw directory entry and then "walks the FAT" to get the remaining clusters. (Because of the low-level calls that PCMFAT and READ-BOOT make, they will exit with error messages on many network drives and on some local drives if a network is running.)

DIRECTORIES

Following the FAT is the final section of the system area of the disk, namely, the root directory. The number of files you can fit in the root directory is fixed according to the following table:

DISK TYPE	NUMBER OF ROOT
	DIR ENTRIES
360 KB	112
720 KB	112
1.2 MB	224
1.44 MB	224
most hard disks	512

Subdirectories, on the other hand, are themselves *files*, so the data area assigned to them can be increased as needed and there is no limitation on the number of files that a subdirectory can have. Directories are also databases with fixed-length records. Each entry in a directory (either root or subdirectory) is a 32-byte record with the following fields:

OFFSET	FIELD
00-07	file name
08-10	file extension
11	attribute byte
12-21	reserved (unused)
22-23	file time
24-25	file date
26-27	starting cluster
28-31	size in bytes

Several facts about this structure deserve notice. First, as a database with fixed-length records, the filename occupies 8 bytes, even if the file has only three characters in its name (FOO.BAR, for example). The record is simply padded (to the right) with space characters, and DOS does not need the period to separate the filename and its extension.

The file time and date reflect the last change made in the file. They are written in encoded form so that they occupy only 2 bytes. However, since there are 86,400 seconds in a day—which is more than the number of possibilities (64K) that can be described by just 2 bytes—file times have a granularity of 2 seconds. As I noted previously, the starting cluster number for a file is part of its directory entry. This number occupies 2 bytes, so to go beyond 16 bits would require redesigning the directory as well as the FAT.

The size field, on the other hand, is 4 bytes, which allows file sizes of up to 4 gigabytes. In this, the designers of DOS showed considerable foresight. Had they

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stopped at 3 bytes, file sizes would have been limited to 16MB. That would have seemed plenty big at the time, but would already be crimping some applications.

The reserved, unused entries occupy 10 bytes. While a few programs have used them to store additional information, this invariably produces conflicts with some programs that look for the default spaces in those positions.

The designers of DOS showed considerable foresight by allowing for size fields of 4 bytes—if they had stopped at 3 bytes, file sizes would have been limited to only 16MB.

The attribute byte, at offset 11, is a set of eight on/off switches. That is, each bit serves as a toggle to describe some possible attribute of the file entry. Note that the last 2 bits are currently unused; the meaning of each bit is as follows:

BIT NUMBER	DESCRIPTION
0	Read-Only
1	Hidden
2	System
3	Volume Label
4	Subdirectory
5	Archive
6,7	Unused

The purpose of the archive bit is to assist in keeping track of file backups. Whenever a file is created or modified, DOS sets this bit to 1. When a backup program backs the file up, it changes the bit back to a 0. That way, when you tell your backup program to do an *incremental* backup, the program can spot just those files that need to be backed up simply by

looking at which have an archive bit of 1. You can use the DOS ATTRIB program or PC Magazine's ATTR.COM to modify this attribute if you need to.

As I mentioned earlier, subdirectories are themselves files that reside in the data area. However unlike regular data files, they have two directory entries at the beginning for the directory itself and its parent directory. The first cluster entries for these directories are useful pointers that

DOS uses in traversing the directory tree when looking for files.

That completes our overview of the logical structure of the disk. In the next installment of this column, we'll see how both DOS and the major file utility programs go to work restoring that structure when disaster strikes.

Barry Simon is a contributing editor of PC Magazine.

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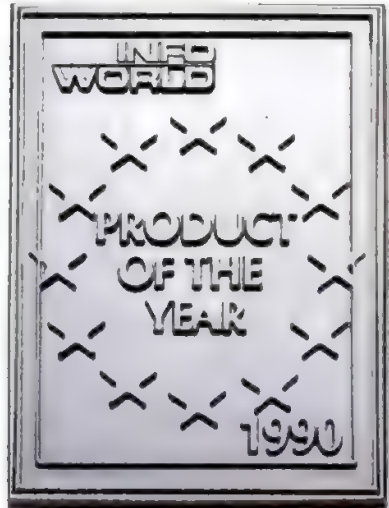
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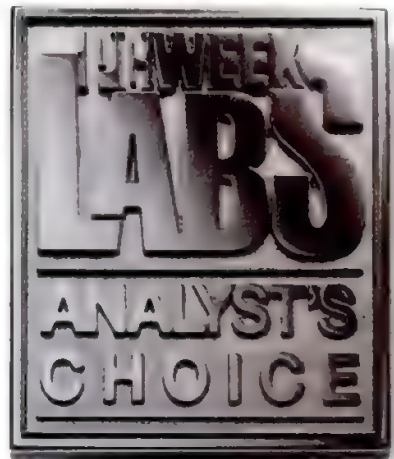
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by
Douglas Boling

Utilities

Batch files are quick, simple—and frustratingly limited. They can't ask you questions or interpret your answers. They can't parse a filename, tell you how much space is left in your environment, or even perform simple math. Yet despite their shortcomings, a dozen times a day it's to batch files that we must turn for routine tasks.

By executing STRINGS.COM from within your batch files, however, you can make .BAT files do things they could never accomplish on their own. STRINGS removes many of the restrictions imposed by the limited batch file vocabulary. For example, you'll be able to perform standard string manipulations, such as separating a filename from its extension, finding one string in another, determining the length of a string, and even reading and writing files.

STRINGS can store its results in environment variables that other programs (or subsequent calls to STRINGS) can access. It provides simple functions that allow batch files to ask a user for input, determine exactly what he entered, and then pass that input to other programs. STRINGS even includes simple but effective math functions.

STRINGS.COM, as well as its assembly language source code file, can be downloaded from PC MagNet. Access instructions are given in the PC MagNet News page, which follows this article. If your communications setup can't handle binary files, you can download STRINGS.BAS instead. When run in BASIC, this listing will create the .COM file. If you modify the source code (to add additional functions of your own, for example), you will need to use a macro assembler and the commands

```
MASH STRINGS;  
LINK STRINGS;  
EXE2BIN STRINGS STRINGS.COM
```

If you don't have a modem at all, you can get a copy of the *source code* by mail or fax. Simply send a postcard with your name and address (or fax number if appli-

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cable) to the attention of Katherine West, Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016; no phone calls, please.

USING STRINGS

To execute the program, either from within a batch file or from the DOS prompt, you enter STRINGS, followed by the desired command function and its necessary parameters. The full syntax is

```
STRINGS [/?][/M][/Pc][environment  
var =] FUNCTION [str1][, str2]  
[, str3]
```

Thus, for example, to return the left 6 characters of a string, you might enter

```
STRINGS LEFT This is a string, 6
```

To store the `This i` result, you would simply insert the name of the destination environment variable, followed by an equal sign, before the command. Thus, to assign the results of this example in the environment variable `VAR1`, your command would be

```
STRINGS VAR1 = LEFT This is a  
string, 6
```

STRINGS would find or create the environment variable `VAR1` in the local environment and assign the value `This i` to it.

STRINGS defaults to using the local command-shell environment to store environment variable results, because that is what batch files use when substituting strings for environment variables. However, by including the `/M` switch before the variable name, you can force STRINGS to use the system master environment instead of the local command processor environment. As will be discussed in fuller detail later, you will use this ability in establishing communications among different DOS sessions running under *Windows*.

Another situation in which the `/M` switch comes in handy is when you "shell out" to DOS from within a running program. When a program shells out to DOS, a copy of `COMMAND.COM` and the accompanying environment are created. Any environment variable assignments STRINGS makes during this shelled session will be lost when you exit from DOS back into the original program, however. If you want to keep any STRINGS assignments made during a shelled session, use the `/M` switch.

STRINGS provides two additional command line options. The `/?` switch simply displays a help list of the STRINGS function commands. These are shown on the back of the DOS manual page printed with this article.

The second command line switch is `/Pc`. Since many strings contain spaces, by default, STRINGS uses commas instead of spaces to separate multiple command parameters. If any of the parameter strings themselves contain commas, however,

Utilities

you can use the /Pc switch to force STRINGS to employ any unused character as *c* to differentiate one string from another. Thus, for example, using /P\$ changes the parse character to the dollar sign (\$).

After a parse character is found, STRINGS scans for the first nonspace character to begin the next parameter. This process has the effect of ignoring any leading spaces a parameter may have. To force STRINGS to respect leading spaces, therefore, STRINGS has been written to interpret consecutive parse characters as the beginning of a parameter.

For example, if a string with leading spaces is to be written to a file, the line

```
STRINGS WRITE c:\file.out, ,, This  
line has 3 leading spaces
```

should be used. Without the consecutive commas, STRINGS would begin the next parameter with the letter T. Using the double parse characters, STRINGS will not append the commas to the line but will keep the proper number of spaces in the string before the word *This*.

One additional character requires special handling. DOS uses the equal sign (=) in assigning a variable name to a value. What happens, then, if the string parameter you want STRINGS to read into a variable itself contains an equal sign? You might, for example, want STRINGS to read the line

```
DEVICE=HIEMH.SYS
```

from your CONFIG.BAT file and assign this as VAR2.

STRINGS handles this situation by changing the equal sign character *within the string* into the similar-looking but wider ASCII 205 (CDh) graphics character (=) before assigning the string to an environment variable. In this example, then, the string actually stored in the environment would then look like

```
VAR2=DEVICE=HIEMH.SYS
```

When it reads an environment variable containing the graphics = character, STRINGS knows to make the reverse substitution of the normal equal sign. The only thing you need to be aware of is that a program *other* than STRINGS will not know

about the need to convert the graphics equal sign back into a regular equal sign in environment variables stored by STRINGS.

A final reminder for using STRINGS: DOS limits the length of a program command line to a maximum of 127 characters. Long strings stored with short names may run up against this limitation when interpreted.

COMMAND FUNCTIONS

Several of the STRINGS command functions have been used illustratively above, but a more systematic description of the complete function set is in order. The functions can be divided into four main groups: (1) string manipulation; (2) file operations; (3) system functions; and (4) math functions.

(1) The string manipulation functions start with the LEFT and RIGHT functions. As shown in the first example, LEFT returns the first *n* characters of a string. RIGHT operates similarly: The first parameter you supply is the string, and the second parameter is the number of characters you want returned. In both cases, if the string is shorter than the number you specify, the entire string is returned. If the second parameter is 0, both functions return a null string.

Assigning a null string to an environment variable removes the variable from the environment. For example, if the environment contained the variable PLAY=1234 and the command

```
STRINGS PLAY = LEFT abcd, 0
```

was entered, STRINGS would erase the variable PLAY from the environment. Note that STRINGS makes no attempt to display null strings on the screen.

The MID function is used to return a substring starting at any point within the original string. As with the LEFT and RIGHT commands, the first parameter you enter is the string itself. The second parameter is the numerical position of the starting character. The third parameter is the requested length of the string you want returned. If the starting character is higher than the length of the string, a null string is returned.

Not surprisingly, the LENGTH function returns the length of a string. The only parameter required for this function is the string itself. The number returned is itself an ASCII string. For example, if a string is 12 characters long, LENGTH returns the

number 12 as an ASCII 49 followed by an ASCII 50.

The FIND and FINDC functions search a string for a given string of characters. If the string is found, the number of the starting position of the string within the original string is returned. FIND searches for the string without regard to case; FINDC considers case in its search.

The LOWER and UPPER functions set the case of the string. LOWER reduces all the characters in a string to lowercase; UPPER capitalizes a string.

The CHAR and VAL functions in STRINGS correspond to the CHAR\$ and VAL instructions in BASIC. The CHAR function returns an ASCII character for the number passed. For example, the STRINGS CHAR 65 command returns the character A, since 65 is the base 10 ASCII code for the character A.

The VAL function is the inverse of the CHAR function, it returns the ASCII number for a character. For example, the VAL B function returns the number 66.

(2) The file operation group of STRINGS functions is best introduced starting with FILENAME, which parses out the filename from within the string supplied. For example, the command

```
STRINGS FILENAME C:\UTIL\EDIT.COM
```

returns the string "EDIT". Similarly, the FILEEXT function returns the file extension—in this case, COM. If a filename is longer than eight characters, only the first eight characters are returned; no more than three characters will be returned by FILEEXT. If the filename cannot be found within the string or if an illegal filespec is supplied, a null string is returned.

The file READ and WRITE functions allow batch files to perform rudimentary file processing. While file processing via a batch file is obviously slow, it can be useful in some situations.

The READ function reads a given line from a file. The parameters you must pass are the filename and the line number within the file to be read. STRINGS determines line numbers by counting the carriage returns (13h) in the file, starting with line 1. If an attempt is made to read either line 0 or a line beyond the end of the file, an error message is printed and an ERRORLEVEL code of 1 is returned.

A typical use for the READ function is in parsing the results produced by piping a find file utility to a file. STRINGS can then be used to read the filenames (which will

Utilities

each occupy one line) from the file. These filenames could then be used in conjunction with other DOS commands to process each of the files individually.

The WRITE function writes a string to the end of a file. If the file does not yet exist, it will be created. If the specified file has a read-only attribute, an error message is printed and an ERRORLEVEL code of 1 is returned. The WRITE command is functionally identical to the following batch file command

```
ECHO string >> filename
```

This command is included in STRINGS to complement the READ command.

The FILESIZE and LINESIZE functions both return information about the size of a file. FILESIZE returns the size of a file in bytes; LINESIZE returns the number of lines in the specified file.

The TRUENAME function creates a fully specified filename, complete with drive letter and path. This function corresponds to the undocumented TRUENAME function available in DOS 4.0 and later. Note that network names and aliases created from the JOIN, SUBST, and ASSIGN commands are resolved to produce the actual drive and path. If an illegal filename is passed to the function, a null string is returned.

(3) Five system functions are provided to assist batch files in determining the system configuration: VER, ASK, ENVFREE, ENVSIZE, and MASTERVAR.

The VER function returns a string containing the current DOS version number. The major version number is reported in the hundreds position, and the minor version numbers are in the tens and ones places. Called under DOS 3.3, for example, VER returns the string "330".

The ASK function allows you to query the user and store his response as an environment variable. ASK can print a specified prompt string to the screen; it then waits for the user to respond with up to one line of input. For example, given the command line

```
STRINGS NAME = ASK What is your  
name?
```

STRINGS will print the string "What is your name?" and then wait for the user to

enter the response and press Enter. The response will be stored in the environment variable NAME.

One important application of the ASK function is in accepting piped output from another DOS command. For example, to create a string containing the current directory, the following line could be used:

```
CD | STRINGS CURRDIR = ASK
```

The environment variable CURRDIR would then contain the current directory.

Since the STRINGS utility depends so heavily on the environment block, it is only sensible to include the ENVFREE function, which returns the number of bytes free in the environment. If the /M parameter is used with this command, ENVFREE returns the bytes free for the master rather than the local environment.

The command ENVSIZE returns the total size of the environment block. This function is useful when a batch file needs a larger environment and must determine the new size of that environment. As with the ENVFREE command, ENVSIZE returns the size of the master environment if the /M switch is used.

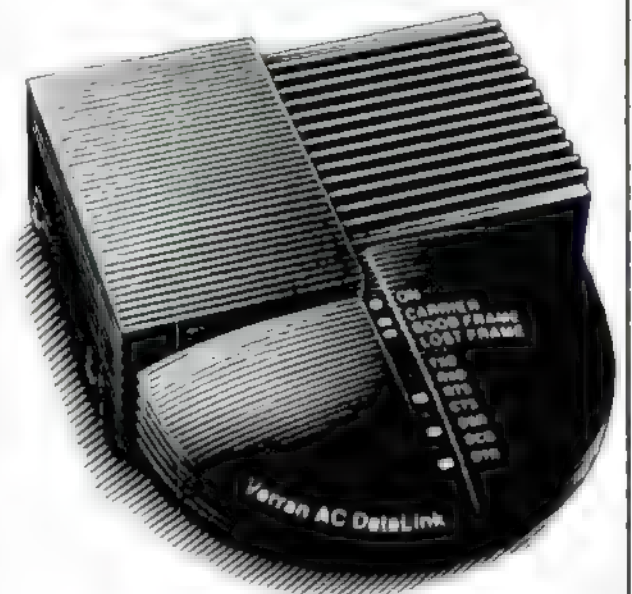
The MASTERVAR function returns the value of an environment variable from the master environment block. This function allows a user to read a value from the master environment block and store it in the local command processor environment block.

As suggested earlier, one important use for the MASTERVAR function is in communicating between different DOS sessions running under Windows, DESQview, or similar programs. This is accomplished by using STRINGS with the /M switch to assign a value to a variable in the master environment. Then, when in another DOS session, STRINGS can be used to read the value of that variable by invoking the MASTERVAR function.

(4) To round out STRINGS' capabilities, I've included simple unsigned arithmetic functions. The ADD function, as you would expect, sums two (base 10) numbers. The numbers are passed as strings, and the result is a string containing the sum. The remaining SUB, MUL, and DIV functions perform as would be expected, taking two numbers as input and returning the result.

If an illegal or overlarge number is passed to any of the math functions, the function is aborted, and a null string is returned. STRINGS also handles overflows,

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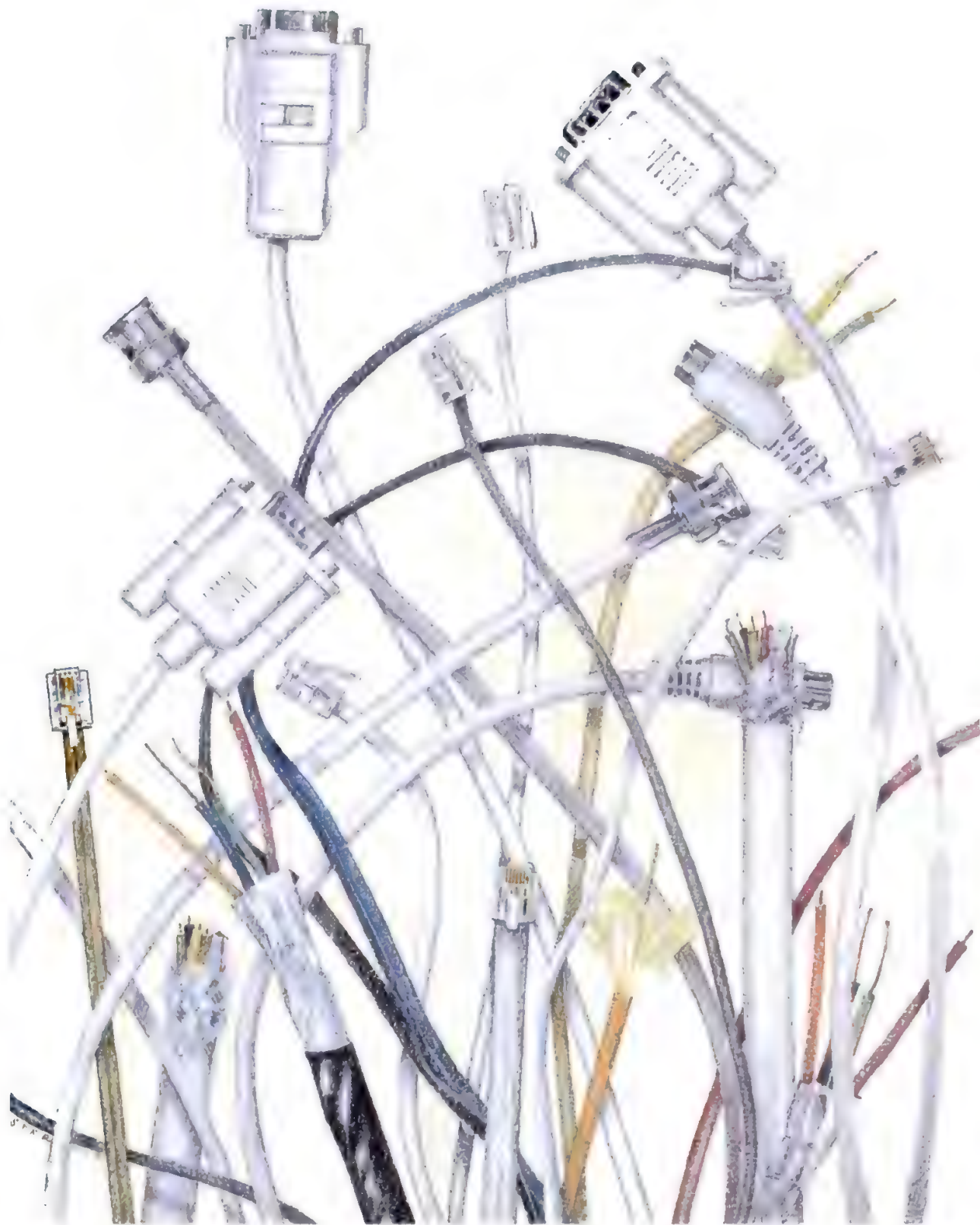
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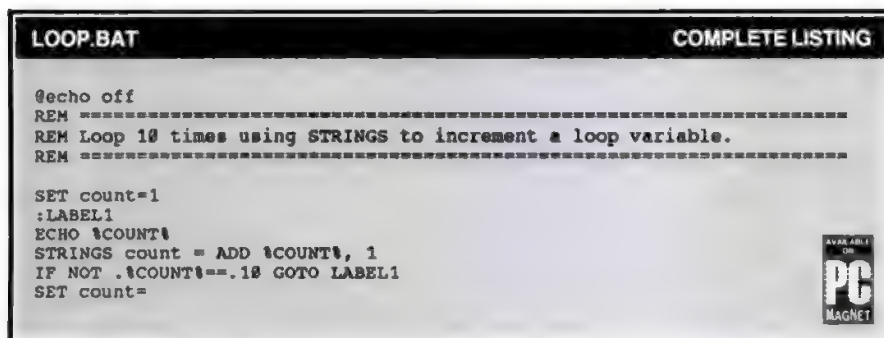


Figure 1: LOOP.BAT uses STRINGS's ADD function to create a looping batch file.

underflows, and divide-by-zero errors with the same null string result. Since STRINGS uses unsigned 32-bit arithmetic, however, the possible values for numbers range from 0 to a rather hefty 4,294,967,295.

An additional function of the SUB command should be noted. SUB responds with an ERRORLEVEL code of 1 if the result is negative. This enables the function to serve as a useful *compare* command. For example, if one of your batch files uses the CALL command—which is available only under DOS 3.3 and later—you might want to include the following sequence:

```
STRINGS var = VER
STRINGS SUB %VER%, 330
IF ERRORLEVEL 1 GOTO end
CALL NEWFILE.BAT
:END
```

Useful examples of actual batch files that make use of STRINGS are presented and discussed in the next section.

STRINGS AT WORK

The test of a utility such as STRINGS is not how good it sounds when described in an article but how useful it proves in your own batch files. Presented here, therefore, are some short batch files that use the commands in STRINGS to perform functions from simple looping to file processing.

One of the simple things that batch files cannot manage is a FOR loop with more than one line. Shown in Figure 1, therefore, is a short batch file, LOOP.BAT, that uses the ADD function of STRINGS to loop through a sequence nine times.

A frequent batch file problem is to determine how a filename was entered. Did the user type just the filename or was the file extension included? There is no easy

way to parse filenames with standard batch files, but with STRINGS, it's a piece of cake. Figure 2 is a listing for PARSE.BAT, which uses STRINGS to parse the filename. This batch file examines the %1 parameter to see if the user typed the filename on the command line. If not, the ASK function of STRINGS is used to query the filename from the user.

Even after the filename has been entered, a problem remains: Does the filename have an extension? The FILENAME function of STRINGS is used to ensure that there is no extension. (If no default extension was placed in %2, and one wasn't typed by the user, the user is ASKed for an

extension.) Then the extension (either the default or user-entered) is appended with the DOS SET command.

Once the filename has been parsed, the DOS IF EXIST command is used to indicate whether the file actually exists. If the file does not exist, the .BAT file prints an error message, deletes the environment variable, and exits. If the file does exist, the environment variable FNAME now contains the correct filename.

One problem that STRINGS users will soon encounter is the dependence of the program on available space in the environment. To solve this problem, a technique demonstrated in the example SHELL.BAT, shown in Figure 3, can be used.

SHELL.BAT uses ENVFREE to determine whether enough space exists in the environment. The SUB command is used to compare the bytes free value returned by ENVFREE with the required space—in this case 300 bytes.

The SUB command returns an error code of 1 if the result is negative; this feature can be used to compare two numbers. The bytes free is subtracted from the required space. If the bytes free is less than the required space, an error code of 1 is returned.

To prevent printing an error message to the screen, the output of the SUB command is redirected to the NUL device. The



Figure 2: PARSE.BAT uses the STRINGS utility to parse filenames.

Utilities

IF ERRORLEVEL command is used to detect the overflow condition.

If there is enough space, the additional shell statement is not executed. If more environment space is needed, however, the batch file determines the required environment size by using ENVSIZE to get the current environment size and adds the necessary number of bytes.

The proper command shell is executed by using the COMSPEC environment variable, whose /E: switch sets the size of the environment of the shell. The shell statement simply executes the same batch file that was executed using the %0 command line parameter. Since the new shell will have enough environment space, the shell statement need only be executed once.

You've probably often wished that batch files could remember the current disk and directory. The SETLOCAL and ENDLOCAL commands in OS/2 provide this function, but there is no DOS equivalent. SAVEDIR.BAT, shown in Figure 4, brings this capability to DOS.

SAVEDIR uses a combination of piping, redirection, and the STRINGS ASK commands to put the current disk and directory into the environment variable OLDDIR. SAVEDIR then changes the disk and directory.

The LEFT command is used to copy the first two characters from the string stored in OLDDIR to the variable DRIVE. Since the way to change the default drive in DOS is by typing the drive letter, a colon, and then hitting Enter, the variable DRIVE, containing the old disk letter, is simply executed to return to the proper drive. Return to the correct directory is achieved by simply using the CD command with the OLDDIR variable as the argument.

The final example uses STRINGS to process a file. CAPIT.BAT, shown in Figure 5, capitalizes the instructions in an assembly file without disturbing the comments. CAPIT uses a variety of STRINGS functions, including READ, WRITE, FIND, and UPPER.

CAPIT first calls PARSE.BAT to parse the input filename correctly. The output filename is then generated by stripping off the input filename extension and appending the .OUT extension.

The main processing loop of CAPIT first reads a line of the input file into the

SHELL.BAT

COMPLETE LISTING

```
@ECHO off
REM =====
REM
REM Shell out to a new copy of COMMAND.COM to increase environment size
REM =====
REM
REM Determine the bytes free in the current environment.  If there are not
REM 300 bytes free, shell out to increase the size of the environment.
REM
STRINGS efree = ENVFREE
STRINGS SUB 300, %EFREE% > NUL
IF ERRORLEVEL 1 GOTO main

ECHO Bytes free in current environment:
STRINGS ENVFREE

REM
REM Determine the size of the necessary environment by adding the
REM required bytes to the current environment size.
REM
STRINGS esize = ENVSIZE
STRINGS esize = ADD %ESIZE%, 300

REM
REM Shell out using the COMSPEC variable.  The %0 parameter is the name
REM of the batch file being executed.
REM
%COMSPEC% /e:%ESIZE% /c %0
GOTO end

REM
REM This is the main body of the batch file.  Since this is only an
REM example, the only work done here is to print the number of bytes free
REM in the shelled environment.
REM
:MAIN
ECHO.
ECHO Bytes free in shelled environment
STRINGS ENVFREE

:END
SET EFREE=
SET ESIZE=
```



Figure 3: SHELL.BAT can be used to increase environment space.

LINE environment variable. The line is then searched for a semicolon, which indicates the beginning of a comment. If one is found, the line is then split into two strings: one containing the characters before the semicolon, and one containing the characters after. The former are then capitalized using UPPER and the two lines are re-joined and written to the output file.

Note that CAPIT uses the /Pc switch to change the STRINGS parse character. Assembly files contain commas and therefore commas could not be used. The character - was used, since it seldom occurs in assembly language files.

Note also that in CAPIT, double parse characters are used to indicate the start of a parameter. In ASM files, lines often begin with a series of spaces that are important for formatting. The use of the double parse character immediately before the param-

ter forces STRINGS to respect the leading spaces instead of ignoring them.

Batch files will be around as long as there is a C:> prompt. As you can see, from these examples, the functions provided by STRINGS can make your batch files more powerful, easier to write, and even a little more friendly.

PROGRAMMING NOTES

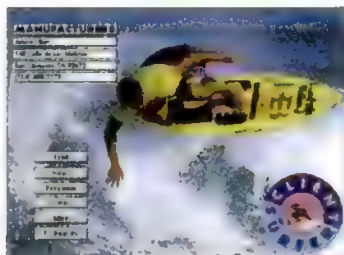
Each time STRINGS runs, it must perform three basic steps: parse the command line, execute the command, and store the result. The job of parsing the command line is complicated by the fact that the different STRINGS commands have different required parameters.

To begin parsing, STRINGS finds the first non-space character. If the character is a forward slash (/) the next character is assumed to be a command line switch. Since

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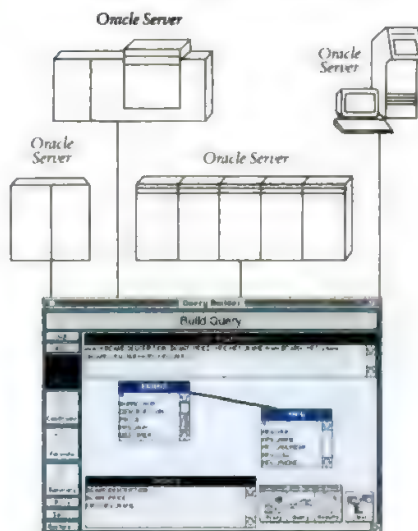
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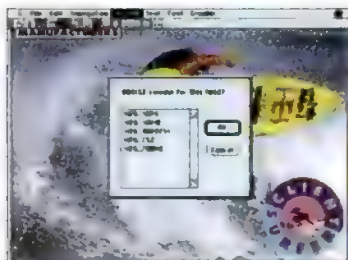
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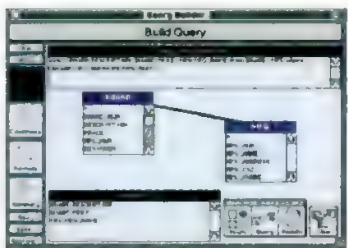
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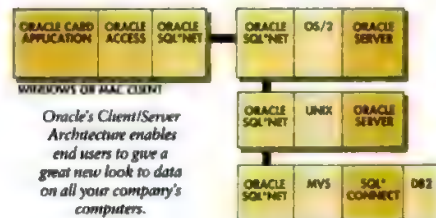
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there are only two such command line switches, parsing is done by a simple compare. If a switch is found, the proper flag is set and the overall parsing continues.

When a word is found without the switch character prefix, an interesting problem arises. Is the word a function name or is it the name of an environment variable? Since there is no way to tell this early in the routine, STRINGS initially assumes that the word is a command and copies it into the command buffer.

The program then scans for the next nonspace character. If that character is an equal sign (=) then the first word must have been an environment variable name and not a command function. If so, STRINGS copies the variable name from the command buffer into the destination variable name buffer. The equal sign is skipped and the next word is copied into the command buffer. The CONSOLE OUT flag is cleared to indicate that the result of the command is to be assigned to an environment variable. If an equal sign is not found, then the first word is assumed to be a parameter.

Command parameters are copied into separate 128-byte buffers. STRINGS copies a string until the proper parse character (usually the comma) is found or until the end of the command line is detected.

If the first two characters in a parameter consist of the parse character itself, STRINGS skips these characters but starts the parameter immediately following the parse characters. This allows strings with leading spaces to be correctly processed.

After the command line has been parsed, the command must be validated and the proper routine must be called to execute it. To validate the command, STRINGS searches through a list of ASCIIZ strings, each of which is the name of a valid command. The end of the list is indicated by consecutive zero bytes.

The format of the command list is the same as the format of a DOS environment block. This allows the same routine that searches the command list for valid commands to be used later to search the environment block for environment variables.

Once the command name has been found in the list, the index into the list is used as an index into a jump table. This jump table contains pointers to each of the routines that implement the commands.

SAVEDIR.BAT

COMPLETE LISTING

```
@ECHO off
REM -----
REM
REM Use strings to save the current disk and directory.
REM -----

REM
REM Pipe the current drive and directory into a env var using the ASX
REM command.
REM

CD | STRINGS olddir = ask > NUL

REM
REM Change to the root directory of the C: drive to leave where we were.
REM

C:
CD \
ECHO on
DIR autoexec.bat
@ECHO off

REM
REM Use the LEFT command to separate the drive letter from the directory
REM string, then change to the proper disk.
REM

STRINGS drive = LEFT %OLDDIR%, 2
%DRIVE%

REM
REM Use the MID command to return the directory string without the drive
REM letter. Change to the proper directory using the CD command.
REM

CD %OLDDIR%

SET drive=
SET olddir=
```



Figure 4: SAVEDIR.BAT saves the current disk and directory.

The pointers are then used to call the proper command procedure.

The command procedures themselves are actually quite simple. Each procedure accesses the necessary command parameters by loading a pointer to the proper parameter buffer. The result of the command is stored in the destination data buffer. The resulting string will later either be used as the string assigned to the destination environment variable or it will be printed to the screen as indicated by the syntax of the command.

The carry flag is used to indicate whether an error has occurred during execution of the command. If the carry flag is set, the result of the command is discarded and the appropriate error message is printed to the screen. For all errors, STRINGS terminates with an error code of 1.

Depending on the state of the CONSOLE OUT flag (set in the command line parse routine), the result of the command is either printed to the screen or assigned to an environment variable.

Before a result can be assigned to an environment variable, however, the environ-

ment must be found. STRINGS can search for either the local command processor environment or the master environment block.

Until recently, a second copy of the command processor was only used when shelling out to DOS from within another program. With the popularity of programs such as *Windows 3.0*, secondary command processors now occur more frequently.

When *Windows* creates a DOS session, a second copy of COMMAND.COM is launched. This second copy of COMMAND.COM creates its own environment, using the strings stored in the master environment. Thus, when a SET command is used or an environment variable in a batch file is needed, it is the secondary environment, not the master environment, that is referenced.

STRINGS defaults to using the secondary command processor environment. To find that environment, STRINGS uses an undocumented pointer, located at offset 16h in the program segment prefix (PSP) block. This pointer identifies the program

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Douglas Boling

STRINGS Command

September 10, 1991 (Utilities)

Purpose:

To enable batch files to manipulate strings, request and interpret user input, process files, return system information, and perform simple math by adding functions to the batch file language. Stores information in either the local or the master environment.

Format:

STRINGS [/?] [/M] [/Pc] [environment var =]
FUNCTION [str1][, str2][, str3]

Remarks:

Entered with the /? switch, STRINGS presents a multiscreen help list of its FUNCTION calls and their user-supplied parameters (*str1*, *str2*, *str3*), printed on the other side. By default, STRINGS uses the local environment (as do batch files) to store user-named environment variables; the /M switch places these in the master environment, where they can be accessed by multiple DOS sessions under Windows. The /M switch is also useful for preserving variable assignments made when shelled out from an application; the default local environment is lost when you exit from DOS back into the running program.

The parse character, used to separate parameter strings, can be changed from the default comma to any unused character *c*, by specifying the /Pc switch. Leading spaces before a parameter string are normally ignored; they can be preserved by doubling the parse character (not printed) immediately before the beginning of the parameter.

To illustrate the syntax using one of the functions listed, if executed from within a .BAT file, the command

**STRINGS /M XYZ = MID This is a sample
string, 11, 6**

would store the word **sample** (which starts with the 11th character in the parameter string and itself occupies 6 characters) under the variable name **XYZ** in the master environment. STRINGS could later be used to retrieve this value by using the MASTERENV function and specifying **XYZ** as its parameter.

A null string is returned if 0 characters are specified when using the LEFT or RIGHT functions or if a starting character larger than the string length is requested when using the MID function. Assigning a null string to a variable erases that variable name from the environment.

CONTINUES

ERRORLEVEL 1 codes are returned by attempting to READ line 0 or a line number greater than those contained in the specified file and by attempting to WRITE (append a line to) a read-only file. The SUB (subtract) function also returns an ERRORLEVEL 1 code when the result is a negative number; this can be used by a batch file to implement a compare function.

The table below lists the functions supported by STRINGS, together with the parameters to supply. A fuller account of each of these is printed in the original article.

Function	Description	Parameters to supply
LEFT	Returns left <i>n</i> characters	String, number of characters
RIGHT	Returns right <i>n</i> characters	String, number of characters
MID	Returns middle <i>n</i> characters	String, starting character, length
LENGTH	Returns string length	String
FIND	Finds position of findstring	String, findstring
FINDC	Case-sensitive FIND	String, findstring
LOWER	Returns string all lowercase	String
UPPER	Returns string all uppercase	String
CHAR	Returns ASCII value of character	Character
VAL	Returns ASCII character of number	Number
READ	Returns a line from a file	Filename, line number
WRITE	Writes string to end of file	Filename, string
FILESIZE	Returns file size	Filename
LINESIZE	Returns number of lines	Filename
FILENAME	Returns filename	Filespec
FILEEXT	Returns file extension	Filespec
TRUENAME	Returns qualified filename	Filename
ASK	Returns user response	[Prompt string]
VER	Returns the DOS version number	
ENVFREE	Returns the bytes free in the environment	
ENVSIZE	Returns size of the environment	
MASTERVER	Returns a variable from the master environment	
ADD	Returns sum of two numbers	Number, number
SUB	Returns difference of two numbers	Number, number
MUL	Returns product of two numbers	Number, number
DIV	Returns quotient of two numbers	Number, number

ENDS

PC MAGAZINE UTILITIES UPDATES

of all PC Magazine utilities and related files, including source code and documentation. Some recent favorites include PRUNE.COM, PRISM.EXE, DR.COM, TED.COM, PCBOOK.EXE, the archived collections of HP LaserJet utilities (HPLSJT.ZIP), and file manager utilities (FILMAN.ZIP). UPDATE.ZIP is a complete list of all programs updated since their release.

SHWCAT.ZIP is a catalog of the high-quality freeware and shareware available, including that mentioned in earlier issues. Some valuable tools include PKZIP (PKZ110.EXE) and ARCE (ARCE.EXE) for archiving and extracting files, VDE text editor (VDE.ZIP), *AsEasyAs* spreadsheet (ASEASY.ZIP), and *Windows icons* (MGICON.ZIP). All catalogs can easily be printed with two PC Magazine HP LaserJet utilities: PCBOOK lets you create your own booklet, and LASERLST lets you print two pages on a single sheet of paper. If you prefer not to use paper at all, browse the catalogs with BROWSE.COM or WINSMOOTH (WSMOOT.ZIP).

A downloadable index to PC Magazine's product reviews is also available. PCM.EXE is a self-extracting file containing the Computer Library PC Magazine Reviews Index for January 1988 to December 1990. It requires the search files in PCSRCH.EXE. Please read the information file PCM.INF before you download any of these files.

Photocopy this page. Trim and hole-punch the copy and add it to your manual.

Utilities

that started STRINGS. It is not enough just to locate STRINGS' parent, however, so STRINGS uses the same pointer in the parent's PSP to identify its parent. The trace continues until STRINGS finds a PSP that is its own parent. This is the PSP of COMMAND.COM.

Even when the COMMAND.COM PSP is found, the job is still not over. STRINGS cannot use the environment pointer (located at 2Ch) in the COMMAND.COM PSP, since that points to the environment created for it when it was first launched. Secondary copies of COMMAND.COM create a new environment block to use when running, and this is the environment needed. This new environment is located above the copy of COMMAND.COM, and STRINGS traces the memory control block chain to find it.

While searching for the environment of the secondary command processor is accomplished by tracing the PSP blocks, finding the master environment involves tracing memory control blocks from the start of memory. Here the search is complicated by the fact that the rules for finding the master environment have changed recently.

Before DOS 4.0, finding the master environment was easy: It was the first memory block owned by the first installed program in memory. Finding the segment of the master environment was simply a matter of tracing the memory allocation blocks to find the first segment owned by itself, for this indicated that the block contained a PSP. Once found, the trace continued to find the first block owned by that PSP.

DOS 4.0 introduced a new wrinkle, because now, by using the INSTALL keyword in the CONFIG.SYS file, programs can be installed before COMMAND.COM. Fortunately, however, DOS 4.0 also provides a solution. Added to the memory control blocks in DOS 4.0 is the name of the program that owns the block. This allows the trace method to work, modified only to verify the name of the PSPs found.

Once the correct environment has been found, STRINGS must still assign the result to the right variable. The environment is searched for the variable name, and if it is found, the variable string is removed by copying the remaining variables over the target variable. The new string, composed

CAPIT.BAT
COMPLETE LISTING

```

@ECHO off
REM -----
REM
REM Use strings to capitalize the opcodes in an ASM file.
REM -----

REM
REM Use the previous example file PARSE to parse the filename.
REM

CALL PARSE %1 ASM

IF %1name==. GOTO end

STRINGS fileout = FILENAME %1NAME%
SET fileout=%FILEOUT%.OUT

SET lnum=1

REM
REM Read the line to the variable 'LINE'. If no more lines are in the
REM file, STRINGS will return a nonzero return code. Pipe the output
REM to the NUL driver to avoid the 'Line not found' error message.
REM
:LABEL1

SET line=
SET part1=
SET part2=

STRINGS line = READ %1NAME%, %1NUM% > NUL
IF ERRORLEVEL 1 GOTO end

REM
REM Find the offset of the ; character in the line. Don't capitalize
REM characters after the ; since they are part of the comment.
REM

STRINGS /p~ offset = FIND "%LINE%" ;
IF %1OFFSET%==. SET offset=128

STRINGS /p~ part1 = LEFT "%LINE%" %1OFFSET%

STRINGS offset = ADD %1OFFSET%, 1

STRINGS /p~ part2 = MID "%LINE%" %1OFFSET% 128

STRINGS /p~ part1 = UPPER "%PART1%"

REM
REM Write the line to the file. Change the parse character to ~ since
REM the line may contain a comma. Use double parse characters ~ to
REM force STRINGS to respect any leading spaces in the parameters.
REM

STRINGS /p~ WRITE %FILEOUT% "%PART1%PART2% >NUL

STRINGS lnum = ADD %1NUM%, 1

GOTO label1

:END
SET var=
SET fname=
SET fileout=
SET lnum=
SET offset=
SET line=
SET part1=
SET part2=

```

Figure 5: CAPIT.BAT improves the readability of assembly language files by uppercasing instructions but not comments.

of the environment variable, its value, and the joining equal sign, is then appended to the end of the environment strings.

STRINGS checks the size of the environment block to determine whether the new string will fit. If the block is too small, STRINGS calls DOS function 4Ah to real-

locate memory for the environment block. If the reallocation call fails, STRINGS terminates with an Out of Environment Space message. ■

Douglas Boling is a contributing editor of PC Magazine.



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PC MagNet News

The Latest Files and Features of PC Magazine's On-line Service

On-line Guide to PC MagNet

As strange as it may seem, some people find the vast territory of the PC MagNet on-line service a little overwhelming. The expanse of useful information exchange, reference material, and downloadable programs can make navigating around the PC MagNet service confusing. That is why we have put together a few separate guides to make the navigation process as simple as possible.

The first and foremost chaperone on your trip through PC MagNet should be the on-line manual, **MANUAL.ZIP**, located in the Utilities/Tips Forum (**GO UTILFORUM**) in Download Library 1, General Information. This zipped ASCII text file contains every instruction set possible, answering any and all questions about the PC MagNet service. The manual lends reason and rhyme to the menu structure and organization of the on-line service, gives straightforward advice on searching, and even gives a tutorial on transfer protocols and such, while giving tips and techniques for uploading and downloading files. This should be the first file you download if you want full involvement with PC MagNet.

There is also an on-line help area (**GO HELP**) that's strictly devoted to PC MagNet assistance. Connect charges are suspended while you interactively browse through the on-line manual or learn the ropes in a practice forum.

Finally, there's a series of

PC MagNet quick reference cards to serve as a succinct companion guide to the on-line training. Available in many different formats, including ASCII (**QREFTX.ZIP**), *Word-Perfect* (**QREFWP.ZIP**), *Lotus 1-2-3* (**QREFWK.ZIP**), *Microsoft Excel 2.1* and *3.0* (**QREFXL.ZIP**), these are available in **UTILFORUM**, **DL1**, General Information.

So, for those of you who have been intimidated by the grand scale of the PC MagNet menuing organization, we recommend these guides to help you fully appreciate every aspect of the service.

Might As Well Jump!

Our folks in PC MagNet's AfterHours Forum have uncovered another exciting game available as shareware. *Jumpman Lives!* is a clever merge of arcade action and intriguing designs.

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This is the five-dollar shareware version of *Jumpman Lives!*, made available by Apogee Software (the people who brought us Commander Keen). Look for **JMAN.ZIP** in the AfterHours Forum (**GO AFTERHOURS**), **DL3**, Games.—Chris Parker

- **TRAFFICKING HELP:** PC MagNet has a series of on-line and off-line guides to help the beginner along.
- **JUMPMAN LIVES!** Apogee Software contributes another dynamic shareware game to our AfterHours Forum.

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Finding the Number in Your Town

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Using voice: Dial 800-635-6225. Follow the instructions and note the number.

by
Charles Petzold

Environments

Every user gets seven device-independent bitmap (DIB) files with the retail package of *Microsoft Windows*. You can use these DIBs as wallpaper to decorate the *Windows* desktop. Five of the seven bitmaps have 4 bits per pixel to represent the 16 standard VGA colors. The other two are monochrome bitmaps that use 1 bit per pixel.

Enterprising *Windows* users who frequent CompuServe can dig up some 8-bit (256-color) DIBs from the data libraries. Generally, these have been converted from existing files that were in the CompuServe Graphics Interchange Format (GIF). These 256-color DIBs are usable as wallpaper on the IBM 8514/A adapter and on those Super VGA boards that support 256 colors under *Windows*. *Windows* will use the colors in the DIB color table to set a palette for the wallpaper display.

Until just a few weeks ago, I had never encountered a 24-bit-per-pixel DIB. A 24-bit DIB contains 3 bytes per pixel for the red, green, and blue intensities of the pixel. Theoretically, 24-bit DIBs have the ability to represent images with a full range of color to the limits of human perception.

MAKING A 24-BIT DIB

Since I hadn't encountered a 24-bit DIB, I decided to create a few myself. I did this by writing some code for my Sharp JX-100 color scanner. This code is part of a DIB Manager program I'm writing called DIBBLE. Complete source code for DIBBLE should be available in the Environments data library of the PC Magazine Programming Forum on PC MagNet by the time you read this. (Then again, you know about software deadlines!)

The Sharp JX-100 scanner has a mode that sweeps a photograph three different times for the red, green, and blue color primaries. For each primary it sends out the 8-bit intensity values of each pixel in the image. (The Sharp JX-100 scanner is limited to a 6-bit resolution, however.)

Working with 24-Bit Color Bitmaps For Windows

■ Theoretically, 24-bit DIBs can represent an image with a full range of color to the limits of human perception, but first there are obstacles to overcome.

My DIBBLE program creates a 24-bit DIB from this information.

The color photograph I used for this experimentation is a studio portrait of my niece Erika (who was four years old at the time), holding her newborn sister Alyssa. I used the full scanning area of the scanner, which is 3.93 inches wide and 6.29 inches high. At a scanning resolution of 100 dots per inch, the resulting bitmap was 392 pixels wide and 628 pixels high. (I don't know what happened to the extra pixel.) The DIB file with this stored image is 738,582 bytes.

A 24-bit DIB file is actually somewhat simpler than the 1-, 4-, or 8-bit formats. The file begins with BITMAP-FILEHEADER and BITMAPINFO-HEADER structures as usual, but the file doesn't contain a color table. The BITMAP-INFOHEADER structure is followed immediately by the bitmap bits beginning with the bottom row. Each row of pixels can be interpreted as an array of RGBTRIPLE structures with the red, green, and blue values of each pixel. The packed-DIB memory format is the same except that it begins with the BITMAPINFO-HEADER structure.

DISPLAYING THE DIB

If you have a DIB in the packed-DIB memory format, displaying it on the screen is fairly easy. You just pass appropriate pointers into the memory block to the SetDIBitsToDevice or StretchDIBits functions. The result of using SetDIBitsToDevice for the DIB I created is shown in Figure 1. This display uses the default 8514/A palette, so only the 20 standard colors are used to render the image. These 20 colors obviously are not adequate.

There's another problem: When you're displaying the bitmap, the performance is abominable. My PS/2 Model 70 running at 20 MHz required 50 seconds to display this bitmap using SetDIBitsToDevice. During this time, even the cursor is frozen on the screen. When displaying a 24-bit DIB on a 256-color display, I think that SetDIBitsToDevice and StretchDIBits may hold the record for the slowest function calls in *Windows*. I shudder to think what the performance would be if the image were clipped to a nonrectangular region!

If you think about it, though, the poor performance is entirely understandable. *Windows*—or more precisely, the device driver for the video adapter—must convert each 24-bit pixel into an 8-bit pixel-bit value that's an index into the system palette. This involves a nearest-color search between the RGB color of each pixel and the RGB values in the standard palette. I don't know how the *Windows* GetNearestColor function does it, but a nearest-color search usually involves finding the minimal three-dimensional distance within the RGB cube between one RGB color value

Environments

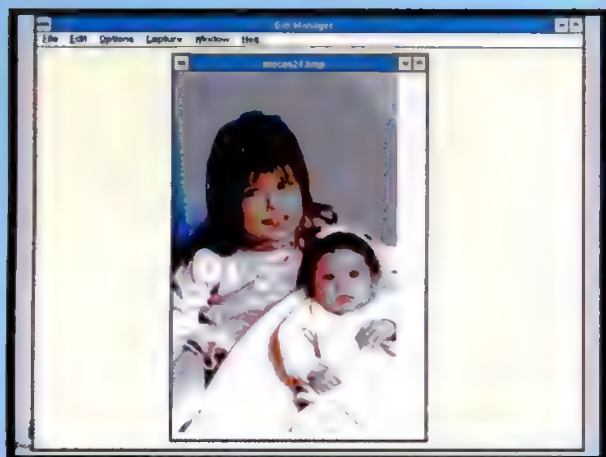


Figure 1: A 24-bit DIB displayed on the 8514/A using the standard palette.

and a set of others. The three-dimensional distance is the square root of the following formula:

$$\sqrt{(r_1 - r_2)^2 + (g_1 - g_2)^2 + (b_1 - b_2)^2}$$

where r_1 , g_1 , and b_1 are the red, green, and blue values of the RGB color to be matched, and r_2 , g_2 , and b_2 are the values of a color in the palette. When comparing these distances to find the minimum, it isn't necessary to take the square root.

There are 246,176 pixels in my DIB. Each of these pixels must be matched to one of the 20 colors in the default palette. This means that the device driver must perform almost 5 million three-dimensional distance calculations. The 50-second display time no longer sounds unreasonable, does it? It's about 100,000 distance calculations per second.

We're now presented with two challenges: improving the accuracy of the colors in the image and speeding up display rendering.

OPTIMIZING THE PALETTE

Let's tackle the first challenge first, which involves finding a palette of 256 colors most closely approximating the range of colors in the DIB image. This is often referred to as an *optimal palette*.

Some friends on the Programming Forum of PC MagNet directed me to a paper by Paul Heckbert that addresses precisely this problem. The paper is called "Color Image Quantization for Frame Buffer Displays" and it appeared in the July 1982

issue of *Computer Graphics*. You should check it out if you're going to be doing work in this area. What I'll discuss here are a few (relatively simple) approaches to the problem.

Finding a good 256-color palette for a particular 24-bit color bitmap requires some experimentation. Indeed (as I'll discuss in a little while), one of the algorithms worked better when I chose an approach that required less memory space and less calculation time.

THE UNIFORM DISTRIBUTION

The simplest approach to a 256-color palette is choosing a uniform range of RGB color values. The advantage of this is that you don't need to examine the actual pixels in the DIB.

Generally this uniform distribution

involves 8 levels of red and green and 4 levels of blue. The palette is the set of RGB color values with all the possible combinations of red and green values of 00, 24, 49, 6D, 92, B6, DB, and FF, and blue values of 00, 55, AA, and FF. You may recall that this is the default Presentation Manager palette on the IBM 8514/A under OS/2 1.1 and 1.2. (Blue gets the coarsest range because the human eye is less sensitive to variations in blue than to red and green.)

Figure 2 shows the results of using this palette. The image is definitely better than Figure 1, but you'll notice that contours (discontinuities in two close patches of color) result in some very splotchy flesh tones.

Another possible uniformly distributed palette uses 6 levels of red, green, and blue. This is a palette of all possible combinations of red, green, and blue values of 00, 33, 66, 99, CC, and FF. The number of colors in the palette is 6^3 or 216.

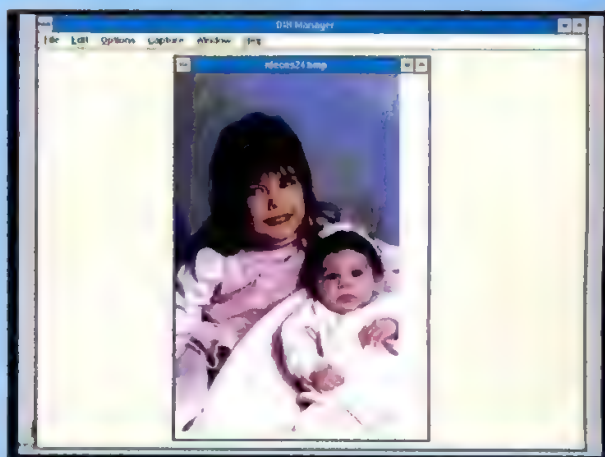
You'll recall that SetDIBitsToDevice required 50 seconds to display my 24-bit DIB with the default palette of 20 colors. What happens with a custom palette of 256 colors? Obviously, the nearest-color search increases by an order of magnitude. SetDIBitsToDevice required 8½ minutes to display the image in Figure 2.

THE POPULARITY ALGORITHM

The "popularity" algorithm is a fairly obvious solution to the 256-color palette problem. The algorithm occurred to me before I even took a look at Heckbert's paper.

What you do is plow through all of the bitmap's pixels and find the 256 most common RGB color values. These are

Figure 2: A 24-bit DIB displayed on the 8514/A using a 256-color palette of uniformly distributed colors.



Environments

the values you use in the palette.

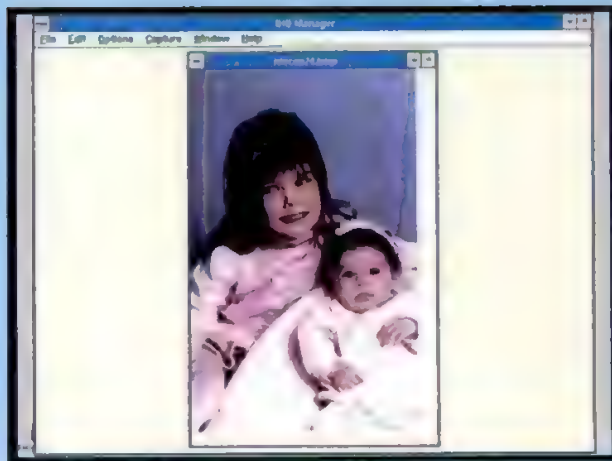
However, to keep track of this information requires an array of 16 million count values, because there are 16 million possible 24-bit RGB color values. Assuming the count values are long integers, you'd need 64 megabytes of memory to hold this array. That's more than *Windows* can handle. Moreover, you may find that there are no duplicated 24-bit pixel values in the bitmap.

To solve this problem, you can ignore the last 2 bits of each 8-bit red, green, and blue value. This makes sense, because most color scanners and video display adapters have only a 6-bit resolution, and doing this reduces the array to a more reasonable size of 256K count values, or 1MB. (Obviously, you'll want to ignore real-mode *Windows* for running such code.)

Sometimes the popularity algorithm works well and sometimes it fails abysmally. Figure 3 shows an example of the latter. What happened here? Well, the 256 most common colors in the 256K array happened to be various shades in the background, the girls' outfits, and the blanket. When it was time to display the bitmap, the colors in the girls' faces had to be matched to one of the 256 most common colors.

The solution is to lower the resolution. Instead of ignoring the bottom 2 bits of each red, green, and blue value, ignore the bottom 3 bits. This reduces the total number of possible colors to 32,768. (Heckbert's paper recommends using a 5-bit color resolution, but I naturally assumed

Figure 4: A 24-bit DIB displayed on the 8514/A using a 256-color palette calculated from the popularity algorithm with 5-bit color resolution.



6 would be better.) Figure 4 shows the results using 5-bit color resolution.

It's very rare to see better results when you're using lower color resolution, less memory, and reduced processing time, but you have to admit that Figure 4 is much, much better than Figure 3. Still, there are some splotchy areas in the girls' faces.

I had another photograph for which the popularity algorithm was deficient. This was a friend's modeling resume photograph. In the original photograph, her light blue eyes were in strong contrast to the colors in the rest of the image, and they almost seem to be glowing. However, the eyes involved very few pixels, so the popularity algorithm didn't find them.

THE MEDIAN CUT ALGORITHM

I found Heckbert's discussion of the *median-cut* algorithm to be the most important

part of his paper. It's conceptually quite simple and while the implementation in code is more difficult, the algorithm is well-suited to recursive functions.

Picture the RGB color cube. Each pixel of the image is a point within this cube. Some points may represent multiple pixels in the image. Find the three-dimensional box that encloses all the pixels in the image. Find the longest dimension of this box and cut the box in two parts, each containing an equal number of pixels. For these two boxes, do the same thing. Now you have four boxes. Cut the four boxes into 8, then 16, then 32, then 64, then 128, and finally 256. Now you have 256 boxes each containing about an equal number of pixels. Average the RGB color values of the pixels in each box and use the results for the palette. In reality, the boxes don't usually contain an equal number of pixels. Often a box containing a single point has many pixels. This happens with black and white. Sometimes a box ends up with no pixels at all. If this happens, you can chop up more boxes, but I decided not to. As with everything else I'm discussing here, code that implements the median-cut algorithm is in the source code of DIBBLE.

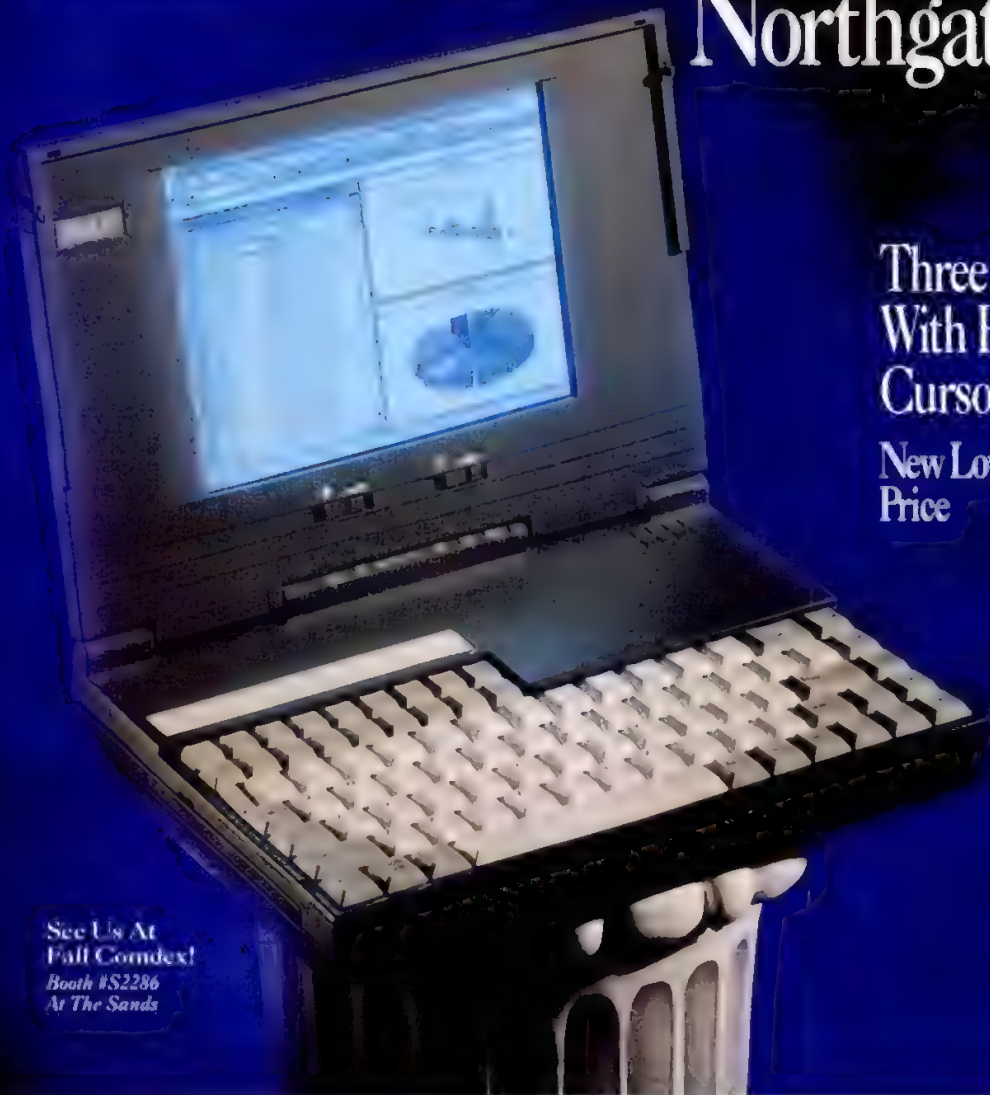
Figure 5 shows the results. Fortunately, I was satisfied with the results in Figure 5, so I wasn't forced to go deeper into Heckbert's paper! Maybe I'll get to it someday.

You should keep in mind that for all these 256-color palettes, the most important colors in the palette should occur at the beginning of the RGB table. I didn't do this for the uniform distribution. But when you're using the popularity algorithm, the best ordering is part of the



Figure 3: A 24-bit DIB displayed on the 8514/A using a 256-color palette calculated from the popularity algorithm with 6-bit color resolution.

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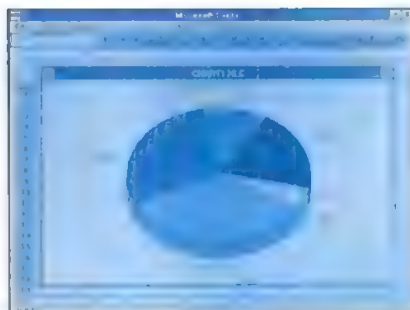
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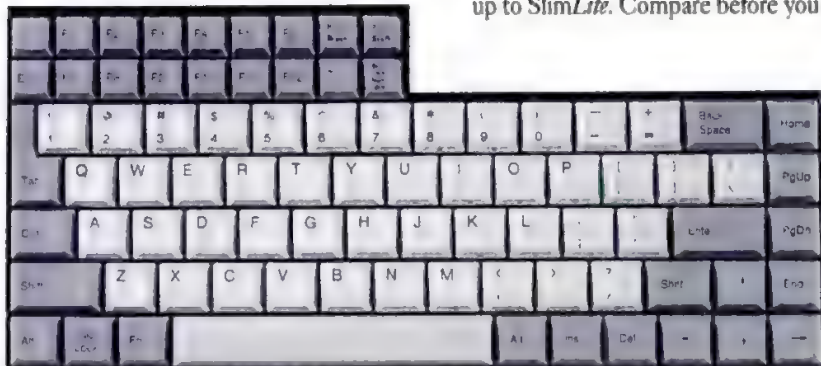


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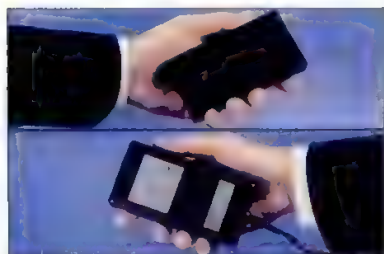
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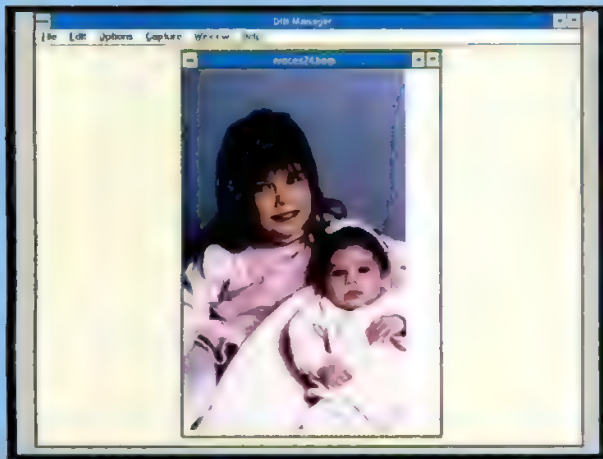


Figure 5: A 24-bit DIB displayed on the 8514/A using a 256-color palette calculated from the median cut algorithm with 6-bit color resolution.

algorithm. In addition, when I implemented the median-cut algorithm, I ordered the boxes so that those with the most number of pixels were first.

SPEEDING UP THE DISPLAY

When a single *Windows* function call requires 8½ minutes to do its work (as `SetDIBitsToDevice` does when displaying this 24-bit DIB using a 256-color palette), you don't want to call that function when processing a `WM_PAINT` message. Every time the window becomes invalid, you'd be stuck with an 8½ minute wait. That's clearly intolerable.

The trick here is to create a device-specific 256-color GDI bitmap object from the 24-bit memory DIB and the 256-color palette by calling `CreateDIBitmap`. You simply select the palette into the device context, realize it, pass pointers from the packed-DIB memory block into `CreateDIBitmap`, and you get back a handle to a GDI bitmap object.

During the `WM_PAINT` message, you select and realize the same palette in the device context, create a memory device context compatible with the display, select the bitmap object into the memory DC, and do a `BitBlt` call from the memory DC to the screen.

Now for the big question: How long does `CreateDIBitmap` require to convert my 24-bit DIB into a device-specific 256-color GDI bitmap object? I don't think you'll be surprised to learn that it requires about the same time as `SetDIBitsToDevice`—50 seconds for the default 20-color palette and 8½ minutes for a custom

256-color palette. After all, `SetDIBitsToDevice` and `CreateDIBitmap` are doing the same job. The difference is that `SetDIBitsToDevice` writes the converted pixel into video memory and `CreateDIBitmap` writes the converted pixel into normal memory.

You'll notice that I haven't mentioned the time required for the various optimal palette algorithms. That's because I still want to make some optimizations in my code. Let's just say for now that they require less than 10 minutes for an image of this size.

So if you have a 256-color adapter and want to experiment with 24-bit DIBs, expect to see the hourglass cursor on your screen a lot. It's unavoidable. Palette optimization requires lots of searching and sorting of big arrays, and many nearest-color searches are required to convert the 24-bit DIB to 8-bit pixel bits.

ANOTHER APPROACH

So far I've been discussing color bitmaps in two formats—the 24-bit DIB stored as a file or in a memory block, and an 8-bit (256-color) device-specific GDI bitmap object stored internally by GDI. The sole purpose of this 8-bit bitmap is to speed up display redrawing.

You can also have 8-bit (256-color) DIBs, but these would usually be constructed from 24-bit color information. I'm building a lot of options into my *DIBBLE* program, and one of them involves creating a 256-color DIB soon after the 24-bit information is obtained from the scanner.

Basically, as the scan is occurring, *DIBBLE* builds a 24-bit memory DIB. Then it allocates memory for an 8-bit memory DIB of the same pixel width and height, calculates a 256-color palette using one of the algorithms discussed above, sets the color table of the 8-bit DIB with that palette, and then performs a nearest-color search to convert each 24-bit pixel into an 8-bit index into the color table. The memory occupied by the 24-bit DIB memory block is then freed. When it's time to display the 256-color bitmap, *DIBBLE* can set the palette directly from the DIB color table.

(By the way, if you need to do a nearest-color search in your own code, you can let GDI do it for you. Create a palette with the color table by setting up the appropriate structures and calling `CreatePalette`, and then use the `GetNearestPaletteIndex` function to find the palette index that most closely approximates a specific 24-bit RGB color.)

Initially, creating a 256-color DIB does not save any time, because the program still needs to perform palette optimization and nearest-color searches. However, the time spent doing this stuff can occur after the scan, and everyone already expects the scan to take some time. Moreover, you can use `SetDIBitsToDevice` to display the bitmap quickly. GDI needs to perform the nearest-color search only between the DIB color table and the palette. Displaying the bitmap pixels then involves a simple lookup between the color table indexes in the DIB to the system palette indexes.

The disadvantage is that you've lost all the 24-bit color information. You can't experiment with various palettes. You have to pick one initially, and if you want to try another you must rescan the photograph.

24-BIT VIDEO BOARDS

I don't have a 24-bit color video board yet, but there are a few low-cost full-color boards with *Windows* drivers becoming available. I hope to report in a later column how these boards work with 24-bit DIBs. Performance should be improved dramatically, because palette optimization becomes irrelevant and no nearest-color searches are required. Unfortunately, we have another problem here at the magazine. We do our screenshots using *.PCX* (*PC Paintbrush*) files, and *.PCX* files don't yet support 24-bit color formats. Getting ready for the future is not always easy. ■

by
Ray Duncan

Power Programming

C++: An OOPL Only A C Programmer Could Love

The ancient Chinese curse "May you live in interesting times!" has been quoted so often that it has become a cliché, but its triteness doesn't make it less appropriate. For better or worse, it is our destiny to try to make a living as programmers during a major shift in programming paradigms—the transition from structured procedural languages such as C and Pascal to object-oriented programming (OOP) languages such as Smalltalk, and C++. Such paradigm shifts are associated with great excitement and opportunity and are often the time when major new talents emerge and reputations are made. But they're also associated with a great deal of anxiety and uncertainty. Everyone reacts to this stress in his or her own way, but reactions seem to fall into four general categories:

■ "It's intuitively clear that OOP is superior to all other modes of programming, and always will be." This attitude is typical of the "early adopters," those who learned OOP as their first language or who made the transition to OOP so long ago that their memories of the aggravation involved have faded away.

■ "I don't see what all the fuss is about. It's really not that big a deal. Besides, I've always done OOP in my own way." These are the people who want to sound hip to the new technology and at the same time remain superior to it—whether or not they actually understand anything about it.

■ "Bah, humbug. COBOL/FORTRAN/C/BASIC was good enough for my ancestors and it's good enough for me." These dinosaurs became oblivious to the fun of programming and learning new things long ago and are just marching in place until Retirement Day.

■ "I just don't get it. I've read dozens of articles about OOP and they all sound reasonable, but as soon as I put the magazine down, the idea slips away from me." Most of the rest of us find ourselves in this group!

It's worth noting that paradigm shifts

■ In C++, the burden of tracking and understanding the relationships in the class hierarchy and enforcing interobject protection rests entirely with the programmer.

are hardly new phenomena in the programming world. In fact, they occur at fairly regular intervals, driven by the inexorable growth of software applications and the eventual inability of a particular paradigm to cope with the size of the programming problems being tackled. (In a way, this points out a striking resemblance between the early adopters of OOPLs and the programming dinosaurs. Both groups ignore the most important lesson of computing history: Something better *always* comes along. The OOP zealots will, in due course, be made obsolete by yet another major advance in programming methodology.)

PARADIGM SHIFTS OF YESTERYEAR

The first major discontinuity in programming occurred when the punch-card or plug-board programming of the early mechanical or electromechanical calculators, which has a lineage stretching clear back to Lady Lovelace, was eliminated by the invention of fully electronic, stored-program computers. This transition, which took place during the late 1940s and 1950s,

was important because special-purpose hardware was replaced by general-purpose hardware controlled by special-purpose software. (Incidentally, for an interesting if somewhat morbid peek at an alternative world where mechanical calculators just got bigger and bigger, see the recent book *The Difference Engine* by Bruce Sterling and William Gibson.)

The second paradigm shift followed hard on the heels of the first. Once people realized that programs in memory were just another kind of data, and like anything else, could be manipulated by the computer, they quickly hit on the concept of program "translators." Translators occur in two types—interpreters and compilers—and their job is to convert the symbolic notations convenient for human beings into machine instructions or bit patterns suitable for a computer. The decoupling of the programmer and the hardware by translators in turn made possible the invention of high-level languages where there was no longer a one-to-one relationship between program statements and the instructions executed by the computer.

The third upheaval in programming, which was in full swing about the time I became interested in computers during high school, was provoked by the recognition that unrestricted transfers of control are a major cause of program bugs. This paradigm shift was marked by the invention of the structured programming languages such as Algol and its daughters C and Pascal, the eventual migration of programmers away from unstructured languages such as FORTRAN and BASIC, and by the appearance of a highly

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specialized species of consultants who write ethereal articles about data-flow diagrams and criss-cross the country giving seminars on zillion-dollar CASE tools. Of course, even in the 1960s and 1970s, the investment in the existing source code base was already so huge that many of the nasty old unstructured languages were gussied up with newfangled control constructs and remain with us today.

Now the fourth revolution in programming is upon us. OOP concepts that have been gestating for 20 years are suddenly invading mainstream programming practice, and structured procedural languages such as C and Pascal are being rapidly superseded by object-oriented hybrids like C++ and Turbo Pascal 6.0. In such times, feelings run high, polarization of attitudes is the norm, and marketing hype is rampant. When they're selling you on the benefits of OOP (and be assured that the benefits do exist), the OOP evangelists gloss over the fact that making the switch from traditional procedural programming is not only hard work, it's *very* hard (for a number of reasons), and there are no shortcuts. The touted benefits in productivity arrive only after a long and painful learning curve.

WHY IS OOP SO HARD?

If you're a conscientious programmer who tries to follow the literature, keep an open mind about new ways of doing things and adopt better tools as they become available, you can't help being buffeted by all this tumult, and you might be prone to feelings of apprehension and self-doubt. It's disconcerting to pick up your favorite magazines and find them cluttered with strange terminology, to visit trade shows where many of the products displayed are utterly alien, or attend lectures where the words sound familiar but the meaning is elusive. But does this mean you've developed a brain tumor, or that everyone else is suddenly smarter than you are, or (horror of horrors) you're getting too old to think straight? Not at all!

The reason that much of the writing about object-oriented programming seems obscure is simply because it is obscure. Not everyone who claims to do OOP really understands OOP, and not everyone who understands OOP writes coherently about it. Every writer in the industry feels ob-

VECTORS.H**COMPLETE LISTING**



```
// VECTORS.H
// Class definition for 2-dimensional vectors
// Member functions are defined in VECTORS.CPP
// Copyright (C) 1991 Ziff Davis Communications
// PC Magazine * Ray Duncan

class VECTOR {
    double magnitude;
    double direction;
    double deg2rad(double);
    double rad2deg(double);
public:
    void display(void);
    void set(double, double);
    void add(double, double);
};

const double pi = 3.141592654;

// vector data type
// magnitude storage
// direction storage
// convert degrees to radians
// convert radians to degrees
// display vector
// set vector value
// add vectors

// constant pi
```

Figure 1: This header file shows a class definition for 2-D vectors.

ligated to go where the action is, whether they know anything about OOP or not (it's even happening in this fundamentalist column). Let me illustrate the lengths to which publishers will go when they spot a new niche: There is actually a book on object-oriented programming in assembly language—a bizarre idea if ever

**The reason OOP
seems so hard is that
before you can learn
anything about it,
you've got so much
to unlearn.**

there was one. As for the software tools marketplace, much of what is being touted as OOP is nothing more than old wine in new sheepskins, old products with new version numbers, old documentation with a thin veneer of new buzzwords.

But the most important reason OOP seems so hard is that before you can learn anything about it, you've got so much to unlearn. Many programmers like to think of themselves as engineers, just as many medical doctors like to think of themselves as scientists. But for the most part, programming, like medicine, is simply a craft. Very few doctors actually "do science," most of them merely do pattern matching (symptoms to disease, disease to appropriate intervention) and a large

amount of amateur psychology. Similarly, although training, innate ability, and certain personality traits play their part, much of what makes you a good programmer is simply doing a lot of it. As you encounter and surmount an ever-widening variety of programming problems, tracking down and eliminating the inevitable bugs in each new module, you build up a repertoire of algorithms, strategies, and coding practices that make the solution of each successive problem a little easier and the occurrence of bugs a little less likely. With time, this knowledge soaks in so deep it becomes almost reflexive.

The trouble is, the reflexes you've acquired using procedural languages don't serve you well in object-oriented languages. In fact, most of them are totally inappropriate for the new paradigm. For example, in procedural languages, we pride ourselves on designing sophisticated data structures, localizing all related variables in one place, and keeping our procedures pure and self-contained with no hidden or magical interactions. Those of us who program in relatively low-level languages such as C on the Intel X86 processor have these principles continually reinforced by the hardware. The Intel hardware protection mechanisms insist that code and data be strictly segregated, that code isn't writeable, that data isn't executable, and that calls across privilege levels must occur only through predefined gateways, and so on.

Compare this approach, which most of us have followed for so many years that it's as automatic as breathing, with a pure OOP milieu such as Smalltalk. The system is built up solely of objects that occur in hierarchies of classes and have both content and behavior; that is, con-

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VECTORS.CPP

COMPLETE LISTING



```
// VECTORS.CPP
// Definitions of Member Functions for Vector Class
// Copyright (C) 1991 Ziff Davis Communications
// PC Magazine * Ray Duncan

#include <math.h>
#include <iostream.h>
#include "vectors.h"

// display magnitude and direction (in degrees) of vector
void VECTOR::display(void)
{
    cout << "magnitude=" << magnitude << " " ;
    cout << "direction=" << rad2deg(direction) << " " ;
}

// initialize magnitude and direction of vector
void VECTOR::set(double magMsg, double dirMsg)
{
    direction = deg2rad(dirMsg);           // initialize direction
    magnitude = magMsg;                   // initialize magnitude
}

// add another vector's magnitude and direction to this vector
void VECTOR::add(double magMsg, double dirMsg)
{
    double angle;                          // scratch storage

    dirMsg = deg2rad(dirMsg);              // convert argument to radians
    angle = dirMsg - direction;            // find angle between vectors

    if (angle == pi)                       // special handling to avoid
    {                                       // overflow for angle=180
        direction = magnitude > magMsg ? direction : dirMsg;
        magnitude = fabs(magnitude - magMsg);
        return;
    }

    if ((magnitude == 0) && (magMsg == 0)) // special handling to avoid
    {                                       // divide by zero exception
        magnitude = 0;                    // if both vectors have
        direction = 0;                    // zero magnitude
        return;
    }

    // calculate resultant vector
    magnitude = sqrt((magnitude * magnitude) + (magMsg * magMsg) +
        (2 * magnitude * magMsg * cos(angle)));
    direction = direction + asin((magMsg * sin(angle))/magnitude);
    return;
}

// private member function to convert degrees to radians
double VECTOR::deg2rad(double degrees)
{
    return ((degrees * 2 * pi)/360);
}

// private member function to convert radians to degrees
double VECTOR::rad2deg(double radians)
{
    return ((radians * 360)/(2 * pi));
}
```

Figure 2: This listing contains the definitions of the member functions for the 2-D vector class.

tain both data and code. Data is spread willy-nilly through the system—parts of the same logical data entity may well be distributed across a completely unpredictable number of objects of different classes. Similarly, the code that responds

to a particular event is not necessarily localized; an object may perform part of the processing for a particular message and kick the rest of the work upstairs to an ancestor class that it has no direct knowledge of at all. The application source code

doesn't reside in any single place where you can print it out and look at it, and there is no sharply defined border between the application and the environment that supports it. Large parts of the application may actually be implemented with, or at least derived from, class definitions—supplied by the language vendor—that are also used to implement the programming tools.

Such a diffuse programming milieu is, predictably, totally baffling to a newcomer accustomed to the Intel X86 architecture and the traditional edit-compile-link-execute cycle. Luckily, the pure OOPs like Smalltalk have had 20 years to evolve programming tools that are closely coupled with the environment. The gory details of object creation and the message-passing mechanisms are carefully concealed, and the creation or maintenance of source code is performed with browsers and inspectors that "understand" the class hierarchy. *Browsers* let you view the class hierarchy at any desired level of detail, declare (subclass) new class definitions based on existing definitions, jump between related class definitions, and cut-and-paste code from one class definition to another. Related tools called "inspectors" let you look at data declarations and their relationships and display or modify the current values of variables. In short, the pure OOPs provide a supportive platform for the software developer, hiding all the elaborate mechanical intricacies of the environment's substructure.

CLASSES AND OBJECTS IN C++

Unfortunately, compared with Smalltalk, C++ is as unsubtle as a frog in a high-school biology class pinned down to a dissection board with its belly open and its guts spread out for easy viewing—and it's just about as elegant. In C++, all of the primitive details of message passing, encapsulation, inheritance, and polymorphism are explicit. The burden of tracking and understanding the relationships in the class hierarchy and enforcing inter-object protection is shifted entirely to the programmer.

Unlike Smalltalk, C++ is not written in itself and it's not self-compiling; instead, it's dependent on compilers designed for another non-object-oriented language (C) for its survival. Consequently, there's a sharp border between the C++ language and C++ applications. One of the unfortunate ramifications is that, rather than being supplied with an elaborate class

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hierarchy that can serve as a jumping-off point for applications, the C++ language comes with only a few rather simple-minded classes for object-oriented stream I/O. This is an object-oriented language that only a C programmer could love.

To illustrate C++'s peculiar nature more graphically, let's turn our attention now to C's structures and C++'s facilities for the declaration of classes and objects. In ordinary C, the `struct{ }` keyword is used to build new data types out of existing data types. For example, we could define a `VECTOR` data type whose members, or components, were the vector's magnitude and direction, as follows:

```
struct VECTOR {  
    double magnitude;  
    double direction; } ;
```

We could then instantiate our `VECTOR` data type—that is, allocate storage for some individually named vector

variables—with code such as

```
struct VECTOR vectorA, vectorB,  
vectorC;
```

New C data types declared with `struct{ }`

An important
capability of C++'s
`struct{ }` keyword is
that it can be used to
define classes.

are not true peers of the native data types because they can't be used with the language's operators in a natural manner. For example, you can't write

```
vectorC = vectorA + vectorB;
```

There are also some fairly severe limitations on the forms that `struct{ }` declarations can take. Most C programmers don't notice the difference, since they've never been exposed to a genuinely extensible language such as FORTH; they take the asymmetry between native and custom data types for granted.

As we saw in the last column, C++ has enhanced traditional C structure declarations in two significant ways: You can use the data type's name alone when instantiating it (you don't have to qualify it again with the `struct` keyword) and you can (in most cases) overload the native operators to handle your newly defined data types. Once you decide to venture into object-oriented programming, however, you find that C++'s `struct{ }` keyword has an additional, much more important capability: It can be used to define classes. Actually, C++ has three keywords for defining classes—`struct{ }`, `union{ }`, and `class{ }`—but since all three use the same syntax (although they're not semantically equivalent) we'll concentrate on `struct{ }` for the moment.

The extension to the `struct{ }` syntax for defining classes is quite straightforward. A class's "member functions" (C++ terminology that's equivalent to Smalltalk's *methods*) are declared inside the `struct{ }` right alongside the class's data members. For example, imagine that we wanted to define a `VECTOR` class with two member variables (magnitude and direction) and one member function (`display`). We would use the following framework:

```
struct VECTOR {  
    double magnitude;  
    double direction;  
    void display(void)  
    {  
        ...  
    }  
};
```

We can then create some vector objects with the declaration

```
VECTOR vectorA, vectorB, vectorC;
```

Finally, we can send a message to a `VECTOR` object to display itself with a statement such as

```
vectorA.display();
```

The member functions of a class can be

TRYVECS2.CPP

COMPLETE LISTING

```
// TRYVECS2.CPP - Try 2-Dimensional Vector Class  
// Compile with Borland C++ 2.0  
// Copyright (C) 1991 Ziff Davis Communications  
// PC Magazine * Ray Duncan April 1991  
  
// Note: Vector directions are input and output in degrees.  
  
#include <math.h>  
#include <iostream.h>  
#include "vectors.h"  
  
main()  
{  
    VECTOR myVector;           // instantiate a vector  
    double magTemp, dirTemp;   // scratch variables  
  
    cout << "\nAdd two vectors.";  
    cout << "\nNote: directions are entered in degrees:\n\n";  
  
    cout << "Enter Vector A magnitude: "; // prompt for Vector A  
    cin >> magTemp;                       // Vector A magnitude  
    cout << "Enter Vector A direction: ";  
    cin >> dirTemp;                      // Vector A direction  
    myVector.set(magTemp, dirTemp);       // set initial vector  
  
    cout << "Enter Vector B magnitude: "; // prompt for Vector B  
    cin >> magTemp;                       // Vector B magnitude  
    cout << "Enter Vector B direction: ";  
    cin >> dirTemp;                      // Vector B direction  
    myVector.add(magTemp, dirTemp);       // add to initial vector  
  
    cout << "\nVector result: ";          // display vector result  
    myVector.display();  
    cout << "\n";  
}
```



Figure 3: This demonstration program can be linked with `VECTORS.H` and `VECTORS.CPP`. `TRYVECS2` prompts you for the magnitude and direction of two vectors, adds them together, and displays the resulting vector.

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coded in two ways. You can put the code for the function right inside the structure, as follows:

```
struct VECTOR {
    double magnitude;
    double direction;
    void display(void)
    {
        cout << "\nmagnitude=" <<
        magnitude;
        cout << " direction=" <<
        direction;
    }
};
```

Alternatively, you can put a prototype for the member function inside the structure declaration and put the actual code for the member function elsewhere:

```
// this class definition has
// only the prototype for the
// member function "display"
struct VECTOR {
    double magnitude;
    double direction;
    void display(void);
};

// this is the implementation of
// the member function "display"
void VECTOR::display(void)
{
    cout << "\nmagnitude=" <<
    magnitude;
    cout << " direction=" <<
    direction;
}
```

The first style is preferred for short, simple member functions that are unlikely to change. This is partly because class definitions are typically kept in header files that are `#included` in all the modules of an application, and partly because the first style causes the code for the member function to be compiled in-line each time it is invoked (avoiding the overhead of a call). The second style is preferred for complex member functions, and the code for such functions is typically not kept in the header file along with its associated class's definition. Invocations of member functions declared with the second "out-of-line" style are compiled as calls by default, although you can also force such

functions to be compiled in line with the `inline` keyword.

The visibility of a class's member data and functions is controlled by your choice of the `struct{ }`, `union{ }`, or `class{ }` keyword when you write the class definition, and by optional `private`, `protected`, and `public` keywords that you can sprinkle around within the class definition. A `private` data member or member function is visible only to other members of the same class definition. A `protected` member can be accessed by all members of the same class or any derived class. Public members are visible to any code—inside the class definition or out—that lies within the scope of the class definition.

The members of a class defined by `union{ }` are all public all of the time. The

Since encapsulation and information hiding are basic OOP tenets, you should give preference to defining classes with `class{ }`.

members of a class defined with the `struct{ }` keyword are public by default, but individual members can be made `private` or `protected` by appropriate placement of those keywords. Similarly, the members of a class defined with `class{ }` are `private` by default, but can be made `public` or `protected` on an individual basis. Since encapsulation and information hiding are basic tenets of object-oriented programming, you should give preference to defining classes with `class{ }` so that the default assumptions by the compiler are the ones most likely to reveal bugs in your application.

Let's look at a simple example of how these keywords work. In our previous definition of the `VECTOR` class, we used the `struct{ }` keyword so that all the members were public by default. This means, for example, that the following code would

be perfectly valid:

```
VECTOR vectorA;

vectorA.magnitude = 100;
vectorA.direction = 0;
vectorA.display();
```

By OOP standards, this code is anathema; the names and types of the variables belonging to an object should be entirely concealed within that object and should only be manipulated by sending messages to the object. If we change our definition of the `VECTOR` class as follows,

```
class VECTOR {
    double magnitude;
    double direction;
public:
    void display(void);
};

VECTOR vectorA;

vectorA.magnitude = 100;
vectorA.direction = 0;
vectorA.display();
```

we get the "politically correct" OOP result. The variables `vectorA.magnitude` and `vectorA.direction` are not visible outside the class definition, and the lines of code that try to assign values to those variables generate a compiler error. In contrast, because the member function `display()` is designated `public`, the code that invokes it compiles without complaint. But now we need some other way to assign values to the data members!

We'll discuss initialization, constructors, destructors, and inheritance next. Meanwhile, here's some code to play with. Figure 1 contains `VECTORS.H`, an expanded class definition for vectors, Figure 2 contains `VECTORS.CPP`, the definitions of the member functions for the vector class, and Figure 3 contains `TRY-VECS2.CPP`, a demonstration program that can be linked with `VECTORS.H` and `VECTORS.CPP`. This code has been tested with Borland C++, Version 2.0, and can be downloaded from PC MagNet.

THE IN-BOX

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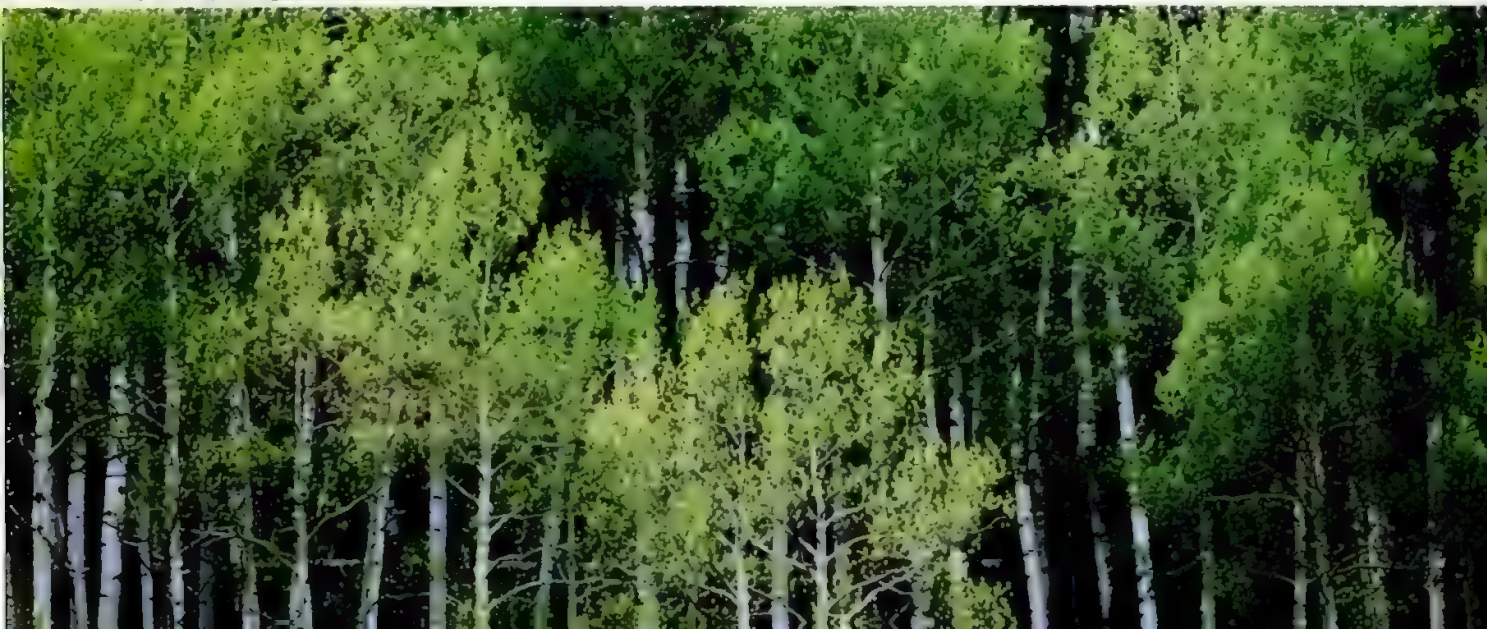
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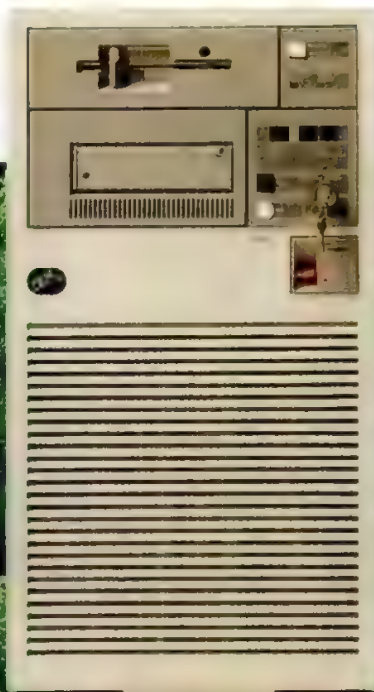
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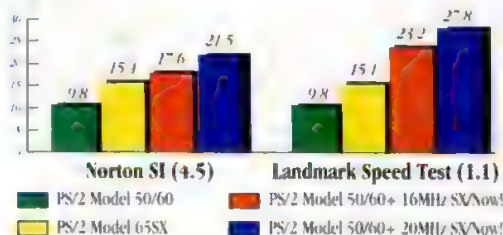
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PCM 891

CIRCLE 106 ON READER SERVICE CARD

by
Fran Finnegan

Windows

STARTING APPLICATIONS FULL-SCREEN

I prefer to run the *Windows* 3.0 Terminal program maximized at all times. This way, I don't have to scroll around to see text that's coming in at 2,400 bps. Luckily, I have discovered an undocumented WIN.INI switch that causes Terminal to start up full-screen automatically.

In the WIN.INI file, locate the [Terminal] section. This section will have an entry for the port (COM1, COM2, and so on) that's used for your modem. Now, back up the file, add the line

```
Maximized=1
```

to the [Terminal] section, and save WIN.INI. If you wish to have Terminal start up as a normal-size window again, you should remove the line or change it to

```
Maximized=0
```

In editing WIN.INI, you can use any word processor that reads and saves ASCII files. The undocumented SYSEDIT is especially convenient, because it automatically creates backups of modified files. And one more note about *Windows*: It is inconsistent in the way it updates WIN.INI. Sometimes I must restart *Windows* to make the Terminal change take effect; other times I don't have to quit *Windows*: Terminal pops up full-screen the first time I load it after editing WIN.INI. To ensure that the change does take effect, you should probably restart *Windows*.

John Castravet

Howell, New Jersey



You must run the Terminal program at least once in order for the [Terminal] section to be created in WIN.INI. The procedure is very simple: The first time it is run, Terminal prompts you for the port that your modem is on. It then creates the [Terminal] section in WIN.INI with a Port=COMx entry. After this, you'll be able to find the [Terminal]

■ **STARTING APPLICATIONS FULL-SCREEN:** An undocumented WIN.INI switch allows you to maximize Terminal at start-up, and a small utility lets you do the same for any application.

■ **DO YOU REALLY NEED 256 COLORS?** Consider your needs when using high-end drivers; though pretty, the extra colors slow you down.

section and add the Maximize=1 line.

You'll see a lot of WIN.INI entries set to 1 or 0. This is a shorthand way of saying yes (1) or no (0). *Windows* has a simple function call that applications can use to get the numeric value.

Castravet's tip was informative. But while shortcuts offer convenience, the usual caveat applies: Undocumented features may be removed in future versions of an application. So if you want to have Terminal start up in a maximized window, I have an alternative solution that doesn't rely on switches that may disappear down the road.

The method involves using my WINEXT program, described in the June 25, 1991, Utilities column. WINEXT allows any application to start up full-screen. Since the complete syntax of the WIN.INI [Extensions] entry or Program Manager Command Line entry required by WINEXT is described in the June 25 issue, I will just summarize the entries you should make to maximize Terminal.

WINEXT can maximize the start-up windows of applications launched by either double-clicking on filenames or by selecting an icon. The WINEXT option

that causes an application to start in a maximized window is the plus sign (+). This option is applicable to any *Windows* application that follows Microsoft's guidelines for opening its main window; most do, but no harm is done if an application chooses to ignore the initial maximization command.

If you want to maximize Terminal by double-clicking on a Terminal (.TRM) file in the File Manager or MS-DOS Executive, the [Extensions] section of WIN.INI should have an entry that looks like this for Terminal files:

```
trm=winext.exe + . terminal  
^ .trm
```

If you run Terminal from Program Manager, the program item Command Line (which is TERMINAL.EXE by default) should have the following entry:

```
winext.exe + . terminal *
```

I put my own .TRM files in a subdirectory called TRM, located under the main *Windows* directory. (This keeps them conveniently in one place.) As such, my generic Program Manager program item Command Line for Terminal looks like this:

```
winext.exe + trm terminal *
```

This line causes WINEXT to switch into C:\WINDOWS\TRM prior to running Terminal. Then, when I execute a File Open command, I am already in the directory that contains my .TRM files.

I also have separate Program Manager program items (icons) for Terminal files I use often. An example of a Command Line entry for one of those is

```
trm\pcmagnet.trm
```

When Program Manager sees this command line, it then looks to the WIN.INI [Extensions] section for the trm= entry,

Windows

which contains the WINEXT reference with the maximize option (+) (as shown above).

Before winding down, I should clear up Castravet's confusion about WIN.INI's seemingly erratic behavior concerning updates. Applications get information from a copy of WIN.INI kept in shared memory. When you manually edit the WIN.INI file, you're editing not the copy in memory, but the copy of WIN.INI that's on your disk. The only way to write manual changes to the copy in memory is by restarting *Windows* or using an application (such as the Control Panel) that writes changes to the memory copy. (Castravet must have unknowingly used such an application on occasion.) An even faster method would be to use my WIN.INI utility described in the July 16, 1991, issue.

DO YOU REALLY NEED 256 COLORS?

Here's an often-overlooked, simple tip for Super VGA users who want speedier *Windows* performance: Examine your needs. Unless you run some highly graphics-intensive *Windows* software, a 256-color driver simply adds unnecessary overhead in screen updates.

I've found that when compared with its 256-color cousin at the same resolution, a 16-color driver will double the speed of screen draws, and there are still plenty of attractive backgrounds available in the 16-color format. If you think this advice sounds trivial, imagine the number of times *Windows* has to open dialog boxes, resize program windows, scroll text, pull down menus, and so on. It all adds up!

If the only 256-color application you run is your screen background, ask yourself just how important a pretty picture is when compared with performance. I recently switched from a 640-by-480 by 256-color screen driver to an 800-by-600 by 16-color driver and will never go back unless absolutely necessary!

Johnny Ow
Kerman, California



In evaluating whether this tip makes sense for you, consider the number of video-memory bytes that your display driver must manage. Video memory is measured in terms of pixel resolution (columns by rows) and number of bits per pixel needed to represent colors. Displaying 16 colors requires 4 bits per pixel (2^4 equals 16) and 256 colors requires 8 bits per pixel (2^8 equals 256). To calculate how many memory bytes your display driver has to manage, multiply the pixel width by the pixel height to get the total number of pixels. Multiply this result by your adapter's bits-per-pixel to find the number of video bits. Then divide by 8 to convert this number to bytes of memory. The table in Figure 1 shows the resulting numbers at various resolutions and color levels.

As you can see from the table, jumping from 16 colors to 256 colors requires the display driver to move around twice as many bytes. That's why, at a given resolution, 256-color drivers operate only half as fast as their 16-color cousins. This speed deficiency can be mitigated by using an accelerated video board like the one based on the Texas Instruments TI-340x0 series. These boards have their own graphics coprocessor, which assumes most of the graphics work that would otherwise be done by your machine's main CPU; by taking over these tasks, the board frees the

CPU to move on to whatever it needs to do after painting the screen.

While a 256-color driver can slow down the system, I wouldn't go so far as to discard the driver. Instead, I would use the *Windows* Setup program (from the DOS prompt) to install drivers for *all* resolutions that my board can handle (almost every video board can handle a range of resolutions). If you have a monitor that can adapt to the signals coming from the board (multiscanning monitors), you can run display drivers for your board's highest resolution or lower ones. Boards for 1,024 by 768 or Super VGA can usually be driven by VGA display drivers and even by those for EGA and CGA. Even if the board does not come with the lower-resolution drivers, you may be able to use the standard ones that come with *Windows*. (Check the capabilities list of your board before installing a different driver.)

Once you've installed multiple drivers, it's a simple matter to switch among the different video modes (again through Setup) depending on the type of work you are doing at the moment. To switch, you again go through Setup, this time from *within Windows*, as long as you've modified SETUP.INF to reflect the extra drivers. By modifying SETUP.INF (per your driver's instructions), you shouldn't even have to reinsert floppy disks once you install a particular driver. For example, if you were doing some desktop publishing for an extended period of time, you might want the highest resolution you can get in order to be as close to WYSIWYG as possible; for simple word processing where speed is more important, you could switch back down to Super VGA or VGA. As a *Windows* application developer, I frequently test my code in 1,024 by 768, Super VGA, VGA, EGA, and even CGA modes. I use the same high-end board and the standard low-end *Windows* drivers to be sure that my software works properly and is attractive in all modes.

OPENING WINDOWS

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VIDEO MEMORY REQUIRED TO MANAGE 16- AND 256-COLOR DRIVERS					
Display driver	Columns	Rows	Bits-per-pixel (colors)	Bits	Bytes
VGA, 16 colors	640	480	4 (16)	1,228,800	153,600
VGA, 256 colors	640	480	8 (256)	2,457,600	307,200
SVGA, 16 colors	800	600	4 (16)	1,920,000	240,000
SVGA, 256 colors	800	600	8 (256)	3,840,000	480,000
8514, 16 colors	1,024	768	4 (16)	3,145,728	393,216
8514, 256 colors	1,024	768	8 (256)	6,291,456	786,432

Figure 1: Looking at the amount of video memory that your display driver has to manage will give you a feel for its relative speed when compared with the memory required in other modes.

by
Sal Ricciardi

Databases

GENERATE A .PRG FILE FROM AN .FRX FILE

We've all experienced the pain and pleasure of trying to design database reports that do exactly what we want them to do. *FoxPro*'s built-in report writer eliminates the painful parts and makes designing reports a pleasure. Its object-oriented nature and built-in preview features make it well suited for the kind of iterative design process commonly used to produce attractive reports.

When you design a report using the report writer, *FoxPro* saves the details of your design to an .FRX file. Then, when you run the report, *FoxPro* uses the information in the .FRX file to generate and format your report.

Unfortunately, *FoxPro* does not include an option to generate source code (a .PRG file) for your report design, and there are times when having source code for the reports can prove valuable. For example, source code can be combined with your main application and compiled; the program that produces the report can simply become a procedure in your main

■ **GENERATE A .PRG FILE FROM AN .FRX FILE:** *FoxPro*'s report writer makes designing reports a pleasure, but only **FRX2PRG** will convert them to source code.

■ **DIALING FROM A DATABASE:** *FoxPro*'s **FOPEN()** and **FPUTS()** functions offer a better way to create a phone dialer.

.PRG file. That means you wouldn't have to supply the .FRX files, and this reduces the number of individual files you'd have to distribute with your application. And if you don't supply the .FRX files, users equipped with a standalone copy of *FoxPro* can't tamper with the report design—another benefit.

Moreover, while *FoxPro*'s report writer is quite capable, there may be something you want to do in your report that *FoxPro*'s report writer cannot easily accommodate. If you can generate source code, though, you can design most of the report in *FoxPro* and then edit the .PRG file, adding whatever custom features you need.

Finally, if you need to port the report to a different *dBASE*-compatible architecture, having the source code will make this task a lot easier.

Many *FoxPro* experts argue that since the package's report writer supports user-defined functions, there is very little you can't do within its boundaries. Nevertheless, if your preference is to generate source code, then **FRX2PRG** may be your best bet.

Developed by Platinum Software International, **FRX2PRG** takes an .FRX file and generates *FoxPro* source code to produce the same report. To generate a program file, you simply pass it the name of your .FRX as a parameter. Figure 1 shows a slightly annotated sample of the code that

PROCEDURE SALDETL

```
*****
PROCEDURE SALDETL      ** Detail record handler
*****
*-- Any record selection criteria should be added to the next statement
SCAN
  mLastRec = mCurRec
  mCurRec = RECNO()
  IF FirstPass          ** If first pass
    DO SALGRHD1          ** Do group header
    DO SALINIT           ** Initialize variables
    FirstPass = .F.
  ENDIF
  DO SALGRP1             ** Check for break processing
  IF _Plineno > mLength - mBotMarg - 5
    DO SALNEWPG          ** Start new page
  ENDIF
  mSQUNT1 = mSQUNT1 + SALES->QUANTITY

  ?? SALES->ORDER_NO FUNCTION "V8" AT 1
  ?? SALES->DIVISION FUNCTION "V18" AT 11
  ?? SALES->REGION FUNCTION "V2" AT 24
  ?? SALES->ORDER_DATE FUNCTION "V8" AT 32
  ?? SALES->QUANTITY FUNCTION "V18" AT 42
  ?? SALES->PRODUCT FUNCTION "V18" AT 54
  ?
ENDESCAN
mLastRec = mCurRec
RETURN

*****
PROCEDURE SALGRHD1      ** Group header 1
*****
```

```
IF _Plineno > mLength - mBotMarg - 7
  DO SALNEWPG          ** Start new page
ENDIF
?? ALLTRIM(PROMPT())+" for: "+ALLTRIM(Reptgroup(mgroup)) AT 1
?
?? "Order #" AT 1       ** Column headings
?? "Division" AT 11
?? "Region" AT 22
?? "Order Date" AT 38
?? "Quantity" AT 44
?? "Product" AT 54
?
?
RETURN

*****
PROCEDURE SALGRFT1      ** Group footer 1
*****
IF _Plineno > mLength - mBotMarg - 7
  DO SALNEWPG          ** Start new page
ENDIF
?? REPLICATE(CHR(196),18) AT 42
?
?? "Total Volume:" AT 27 ** Footer total
?? mSQUNT1 FUNCTION "V18" AT 42
mSQUNT1 = 0
?
?
RETURN
```



Figure 1: A sample of the code produced by **FRX2PRG** using **SALESRPT.FRX**.

Databases

I generated using FRX2PRG and SALES-RPT.FRX, a report presented in the May 14, 1991, issue.

FRX2PRG works by reading the .FRX file and deciphering the meaning of its contents. It generates procedures to handle each of the major bands, or sections of your report, such as detail lines (xxxDETL), group headers (xxxGRHDn) and footers (xxxGRFTn), page headers (xxxPGHD) and footers (xxxPGFT), and so on. (The first three characters of a report-form filename replace xxx.)

The generated code is easy enough for a database programmer to understand, although it is not as generously commented as it could be. Of course, if you're not comfortable reading .PRG files, you're probably not a good candidate for this program. Most reports can be converted by FRX2PRG with good results, but there are undoubtedly one or two that cannot easily be duplicated in source code. For example, if you use the vertical stretch option on more than one character field on the same line, FRX2PRG won't be able to generate a program that duplicates *FoxPro's* results. If, however, you limit vertical stretch to a single field on its own line, as many people do, the program generated by FRX2PRG will work fine.

If you want to generate source from your *FoxPro* reports, FRX2PRG is, as of this writing, the only tool that can do the job. And at \$49 for a single-user version, it's an affordable tool. For more information, phone 301-309-9169.

DIALING FROM A DATABASE

I'm often asked to include the ability to dial a phone number from a database in my *dBASE* and *FoxBASE* applications. In the old days, I accomplished this using the following commands:

```
! ECHO ATDT##### > COM1
```

```
! ECHO +++ATH0 > COM1
```

Then I discovered a whole new set of commands in *FoxPro*. Using FOPEN('COM1',2) and FPUTS(handle, string), I can construct a much more user-friendly phone dialer.

Sebastian Ghosh

Weehawken, New Jersey

DIALMODEM PROCEDURE

COMPLETE LISTING

```
*****
* PROCEDURE DialModem - Illustrate the basic technique for dialing a
* phone number through a modem using the FoxPro low-level file
* input/output functions. No error checking.
*****
PROCEDURE DialModem
PARAMETERS Comport, Phonenum
PRIVATE Modem
Modem = FOPEN(Comport,2)    ** Open port for read/write access

=FPUTS(Modem, 'ATDT'+Phonenum) ** Dial the modem

DO msgwin WITH "Lift handset while ringing, press any key when connected",;
  "","Press any key or click on the mouse now to cancel",;
  "Dialing: "+phonenum+" on "+Comport

=FPUTS(Modem, '+++ATH0')    ** Hang-up command

=FCLOSE(Modem)              ** Close the port

RETURN

*****
* PROCEDURE msgwin - Displays some messages in a window and waits for
* a keypress or mouse click
*****
PROCEDURE msgwin                      ** Display window to user
PARAMETER text, text1, text2, text3
PRIVATE xx, xy, xxx, xyy
xx = (SROWS() - 6)/2
xy = (SCOLS() - 60)/2
xxx = xx + 6
xyy = xy + 61

DEFINE WINDOW msgwin FROM xx,xy TO xxx,xyy TITLE '&text3'
ACTIVATE WINDOW msgwin
@ 1, (60 - LEN(text))/2 SAY text
@ 2, (60 - LEN(text1))/2 SAY text1
@ 4, (60 - LEN(text2))/2 SAY text2
=INKEY(0,'HM')                      ** wait for keypress or mouse click
RELEASE WINDOW msgwin
RETURN
```

Figure 2: DialModem lets users dial a phone number from a *FoxPro* database.



FoxPro's low-level file I/O functions make the RUN command (!) unnecessary in this instance. The FOPEN() function can open either a file or the COM1 or COM2 communications ports, according to the *FoxPro Commands & Functions* manual. Once the COM port is successfully opened, you can use the FPUTS() function to send it the modem's dial command.

The DialModem procedure shown in Figure 2 illustrates the basic technique for dialing a phone number through a Hayes-compatible modem using the low-level file I/O functions. You might use it as follows:

```
DO DialModem WITH "COM2",
Phonenum
```

where Phonenum is a field in the currently open database containing the phone number to dial.

Several caveats are needed: First, in order for this to work, you may have to issue the DOS MODE command to initialize the COM port before running *FoxPro*. For example, the command

```
MODE COM2 2400,N,8,1
```

issued from the DOS command line would set up COM2. Second, you should make sure the modem is turned on and ready when using this technique. If not, *FoxPro* will not protect you from DOS's infamous Abort, Retry, Fail error message. Finally, to save space, the routine in Figure 2 does not include any error checking. A more robust routine would be needed for production applications.

LET US HEAR FROM YOU

Share your database experience, tips, and techniques; we'll pay you \$50 for any tip that we print. Submissions can be mailed to our office or uploaded to PC MagNet. Mailed submissions must be made on-disk, accompanied by a printout, and sent to Databases, *PC Magazine*, One Park Avenue, New York, NY 10016. To upload your contribution to PC MagNet, see the PC MagNet News Page following the Utilities column for access instructions. You may also contact Sal Ricciardi directly via his CompuServe ID number: 72241,33. ■

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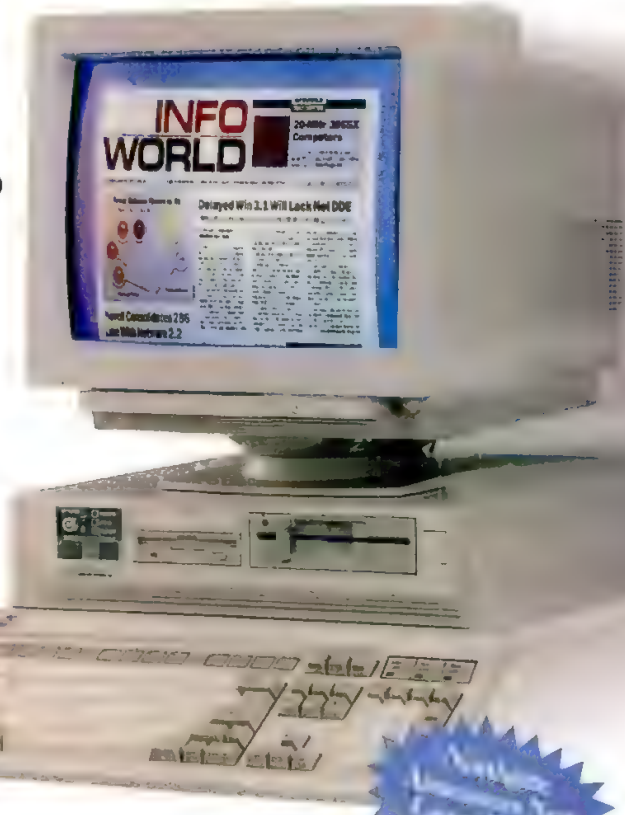


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by
Craig Stinson

Spreadsheets

RESETTING YOUR PRINTER FROM 1-2-3

If you use *Lotus 1-2-3*'s /Print Printer Options Setup command to send a setup string to your printer, that string remains in effect after you've printed. This is true even if you follow the printout with a /Print Printer Clear All command.

For example, suppose you use a setup string to print a worksheet in a compressed font. At the end of the printout, your printer is still set up to use its compressed font, so if you quit 1-2-3 and type, say,

```
COPY LETTER.TXT PRN
```

from the DOS prompt, LETTER.TXT will also print in compressed type!

It would be nice if you could reset your printer from within 1-2-3, without moving the printhead or changing the top-of-form alignment. That way, everything would be clean and ready for the next print job. Unfortunately, 1-2-3 makes it difficult to do this. First, you can't send a setup string without assigning and printing a print range. Second, even if your print range is a single blank cell, 1-2-3 still advances the printhead one line after "printing" that cell.

My solution uses /Worksheet Page to insert a page break. In response, 1-2-3 creates a blank row on the worksheet and inserts the page-break label

```
1::
```

RESET.WKI		
	A	B
1	\r	{home}
2		/wp{up}
3		/ppr{bs}-os{esc}
4		\027\064
5		-ougg
6		cag
7		/wdr-

Figure 1: 1-2-3 doesn't clear setup strings and makes it awkward for you to do it yourself. This macro comes to the rescue. Be sure to replace the Epson reset setup string in B4 with one compatible with your printer.

■ **RESETTING YOUR PRINTER FROM 1-2-3:** You don't have to turn off the printer to clear setup strings. A crafty trick lets you do so right from the worksheet.

■ **COLORING RELEASE 2.01:** In a recent column, we detailed a scheme for modifying the screen colors of Release 2.2. Here, we tackle the same job with the earlier version of *Lotus 1-2-3*.

in the first cell of that row. I use that cell as a print range. Then I select the /Print Printer Options Other Unformatted command, specify my reset setup string (using /Print Printer Options Setup), and print.

The Unformatted printing option causes 1-2-3 to ignore page breaks. Thus, I can send my reset command and print a blank cell without having 1-2-3 advance the printhead. After this, I use /Print Printer Clear All to restore formatted printing.

The macro in Figure 1 takes care of all these details for me. It inserts a new row 1 containing a page-break character, assigns A1 as the print range, sends a setup string to reset the printer, and then deletes row 1. I use this macro often as a final subroutine for other printing macros.

Giovanni Borla
Milano, Italy



The 1-2-3, Release 2.2, Reference manual asserts on page B-6 that "1-2-3 Release 2.2 will automatically reset the printer when you exit from the program." This is *not* true! Any setup string you send to your printer via 1-2-3 remains in effect until explicitly canceled, even after you quit 1-2-3. Many software

programs automatically send a reset command to your printer before printing anything, so you're not likely to run into trouble if you go from 1-2-3 to your favorite word processor. But if you try to print something from the DOS command line after sending your printer a setup string, you will find that string still in effect.

The time-honored method of clearing out setup strings is to reach across the desk and punch the printer's reset button (or turn it off and back on again). This approach requires no programming or /File Combine commands and can be used in any software environment. Nevertheless, it has its drawbacks, particularly for those with large desks, short arms, or network printers. Under these circumstances, Borla's macro should do the trick.

The macro contains the reset setup string for Borla's Epson printer. Check your printer's manual to find out what reset string it requires, and substitute that string for the

```
\027\064
```

in B4.

Note that *Allways*, unlike 1-2-3, does reset your printer after each printout. Thus you can avoid the kind of troubles that Borla describes by printing from *Allways* instead of from 1-2-3.

COLORING RELEASE 2.01

It's obvious that the absence of color-setting commands is a source of widespread frustration among *Lotus 1-2-3* users. A flood of letters—the largest and most enthusiastic response to any column in memory—greeted Michael Cowan's submission in the issue of March 26, 1991. (Cowan revealed how those who use a 25-line EGA/VGA driver can change Release 2.2's screen colors.) Some readers wrote just to say "hurrah"; many others asked how Cowan's technique could be applied to Releases 2.01 and 3.x and other Release 2.2 screen drivers.

On these matters, I bring bad news and

Spreadsheets

good news. The bad news is that Lotus won't confirm the efficacy of Cowan's method or provide any of the other information that readers crave. To those who would change their screen colors, Lotus recommends the :Display Color and :Graph Edit Color commands in *Wysiwyg*—the publishing add-in supplied with Release 3.1 and Release 2.3. This may be an understandable position: *Lotus 1-2-3* is not designed for color customization, and Lotus certainly doesn't want to field tech-support calls from users who tweak their .SET files. Even so, this response won't satisfy the millions who still use Release 2.01 or 3.0, not to mention the many who do have *Wysiwyg* (or *Impress*) but prefer to do their routine work in *1-2-3*'s fixed-pitch display.

The good news is that Release 2.01 users don't really need Lotus's help. Reader James Guerin (Paris, France) has sent us the .SET-file byte sequence—07 30 0A 3F—that governs four of the colors used by the 25-line EGA/VGA driver of that early version. The first byte determines the color of protected text; the second determines the color of the worksheet frame and cell pointer, as well as status indicators, highlighted menu items, and protected text when it lies under the cell pointer; the third byte controls the hue of unprotected text not in the active cell; and the fourth determines the color of unprotected text in the active cell.

The procedure for changing your

1-2-3 colors is as follows:

(1) Make a backup copy of the .SET file you intend to modify. By default, this file is named 123.SET.

(2) With *The Norton Utilities*, DEBUG, or another similar product, open the backup file and search for the hex string

07 30 0A 3F

(3) Replace those values (or some of them) with new hexadecimal values of your choice.

(4) Save the modified .SET file and quit the editor.

(5) Run *1-2-3*, Release 2.01, using the name of your new .SET file as a command line parameter. For example, with the file COLORS.SET, start *1-2-3* by typing

123 COLORS

Note that if you modify your original 123.SET file instead of a copy and you subsequently rerun the Lotus Install program, your colors will be reset to their defaults. Figure 2 shows how your Release 2.01 workspace will appear if you change the byte sequence to 1F 20 14 41.

Before you start changing the values, a little information about what you're changing will be helpful. Each of the 4 bytes consists of a pair of hexadecimal digits. In each pair, the first digit controls the background color while the second digit controls the foreground. For example, the default hex value for protected text, 07, specifies white (7) letters on a black (0) background. The default value for the frame, 30, generates black (0) characters on a background of cyan (3). Each hex digit can be any value from 0 to F. The table shown in Figure 3 lists the colors coded by these values.

For foreground colors, the upper eight values are simply bright variants of the lower eight. If you assign a value between 8 and F to one of the background digits, however, something quite different occurs: The foreground blinks. Changing the first byte in the sequence from 07 to 87, for example, produces blink-

ing white text on a black background. This means, unfortunately, that you cannot set your worksheet text to black on bright white, as you can in Release 2.2

HEXADECIMAL VALUES FOR SCREEN COLORS	
HEX VALUE	COLOR
0	Black
1	Blue
2	Green
3	Cyan
4	Red
5	Magenta
6	Yellow
7	White
8	Black
9	Bright blue
A	Bright green
B	Bright cyan
C	Bright red
D	Bright magenta
E	Bright yellow
F	Bright white

Figure 3: Using this table you can select any colors you want for your screen.

(see the upper-left quadrant of Figure 3 in the March 26, 1991, column). Doing so would require that the first byte be set to F0, and instead of black on shining white you'd get blinking black on muddy gray. (You *can* make your text black on low-intensity white by setting the first byte to 70.)

You should also note that I found two instances of the byte sequence 07 30 0A 3F in my own Release 2.01 .SET file. Editing the first instance had no apparent effect on *1-2-3*'s behavior. Editing the second produced the desired color changes. Guerin's letter suggests that he found only one instance, which leads me to believe that the matter may be less straightforward than he and I hope. If you don't find this sequence in your .SET file, I'd welcome a note. (Specify exactly what kind of equipment you're using.)

I'd also like to hear from anyone with additional information about how color is specified in Release 1A or 2.3. Sharing your knowledge can make you a hero to thousands of Spreadsheets readers!

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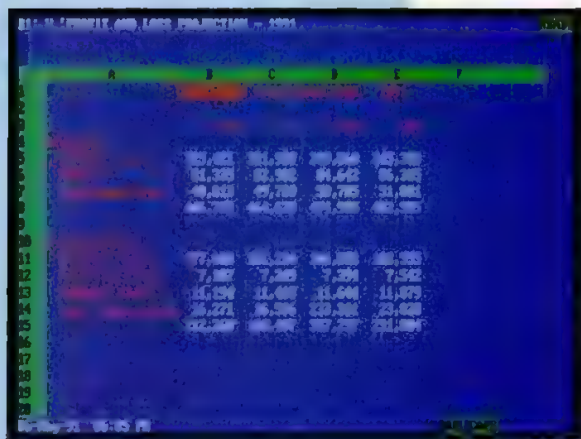


Figure 2: You can change your screen colors in Release 2.01, just by altering the .SET file.

by
Costa Rodis

The Working Word

UPGRADING WORD 5.0 MACROS

Microsoft Word 5.5's new interface is a pleasure to use, but at the same time, it necessitates major revisions to many Word 5.0 macros. In one way or another, almost all macros depend on the menu and command structure of the program—radically changed in Word 5.5. Here's a tip that can make the conversion process smoother.

As it does with Word 5.0, Microsoft furnishes you with initializing macro key names, such as Ctrl-W, so that you can start your macro from any menu and be sure it will run properly. There is one exception: If you execute a File Close All command, all the windows will close, but you will remain in Word. This means you can execute any macro from a windowless screen. Unfortunately, with all the windows closed, most macros can't run. The only error indicator you're likely to get is either a number of beeps or the File menu dropping down.

To avoid this problem, you should prefix your macros with the following commands

```
<<COMMENT Open new window if all  
  windows are closed>>  
<<set echo = "OFF">>  
<<IF Window = 0>>  
  <<alt f>n<Enter>  
<<ENDIF>>
```

This solution opens a new document window if all the windows are closed when the macro starts. Be sure to use a tab to indent the fourth line; do not use spaces.

Bill Kraengel, Jr.

Valley Stream, New York

 Not everyone is likely to consider running a macro from a windowless screen, but for those times you should attempt it, here's a solution.

Moreover, Kraengel's suggestion opens up a number of possibilities for running macros under specific conditions. The statement **IF Window = 0** can be used to allow a macro to run only if there

■ **UPGRADING WORD 5.0 MACROS:** Edit your 5.0 macros so that they can run in a windowless screen.

■ **REPLACING PAIRED CODES:** WordPerfect's Search and Replace feature is useless if you want to comb an entire document and exchange bold, italic, or underline. But CHANCODE.WPM can make the switch quickly.

are no document windows open. Or you can substitute the 0 with a 9 so that a macro operates only if all document windows are open. Alternatively, the = can be replaced with <> to indicate "not equal to." This allows you to have a macro run or cease operation if, for example, the current document window is any number but 5. You can also use the operators < (less than) and > (more than).

Of course you can always add an ELSE statement. That way you could say that if more than eight document windows are open (Window > 8), close and save the current window. Otherwise (ELSE), open an old document.

REPLACING PAIRED CODES

In WordPerfect, you can't use the wildcard character, ^X (Ctrl-V, Ctrl-X) in a replacement string without placing the ^X directly into the text. This limitation means that you can't search for and replace the paired codes for underline, bold, and italic unless you know exactly which characters lie between the pairs; this is useless when you want to replace more than one instance of one attribute with another. If you want to change all the

underlined text of a document to bold, you have to go through the laborious process of deleting the bold code, blocking the text, and choosing underline. And you have to repeat this process for each instance!

I wrote CHANCODE.WPM, shown in Figure 1, to get around this headache. CHANCODE is a replacement macro that deals only with bold, underline, and italic; it lets you replace any one of these three attributes with any one of the other two. You can also choose to confirm each change.

David R. Miller

Ottawa, Ontario, Canada

 The trick to replacing WordPerfect paired codes with others is based on how WordPerfect creates these codes and how the search-and-replace function works.

To see how WordPerfect creates these codes, strike the Underline (F8) key and select Reveal Codes (Alt-F3 or F11). You'll notice that two codes are produced: [UND] and [und]. If you delete one code, the other is automatically deleted as well.

The Search function, however, can find *either* the beginning *or* the end commands of paired codes. Tap the Search key (F2) and then Underline (F8). You'll see the beginning underline code, [UND]. Tap F8 again and [und] (the end underline code) immediately follows the first code. Move the cursor to the left with the Left Arrow key and tap BACKSPACE. The beginning code disappears, leaving the end code alone on the Search prompt line. Tap F2 again, and the cursor will move immediately to the right of the first end underline code it comes across. (You can also insert either half of a paired code at the "Replace with" prompt; however, pressing F2 to implement the replace won't work, because the codes must be paired on the document.)

Miller takes advantage of the search capability in building his macro: CHAN-

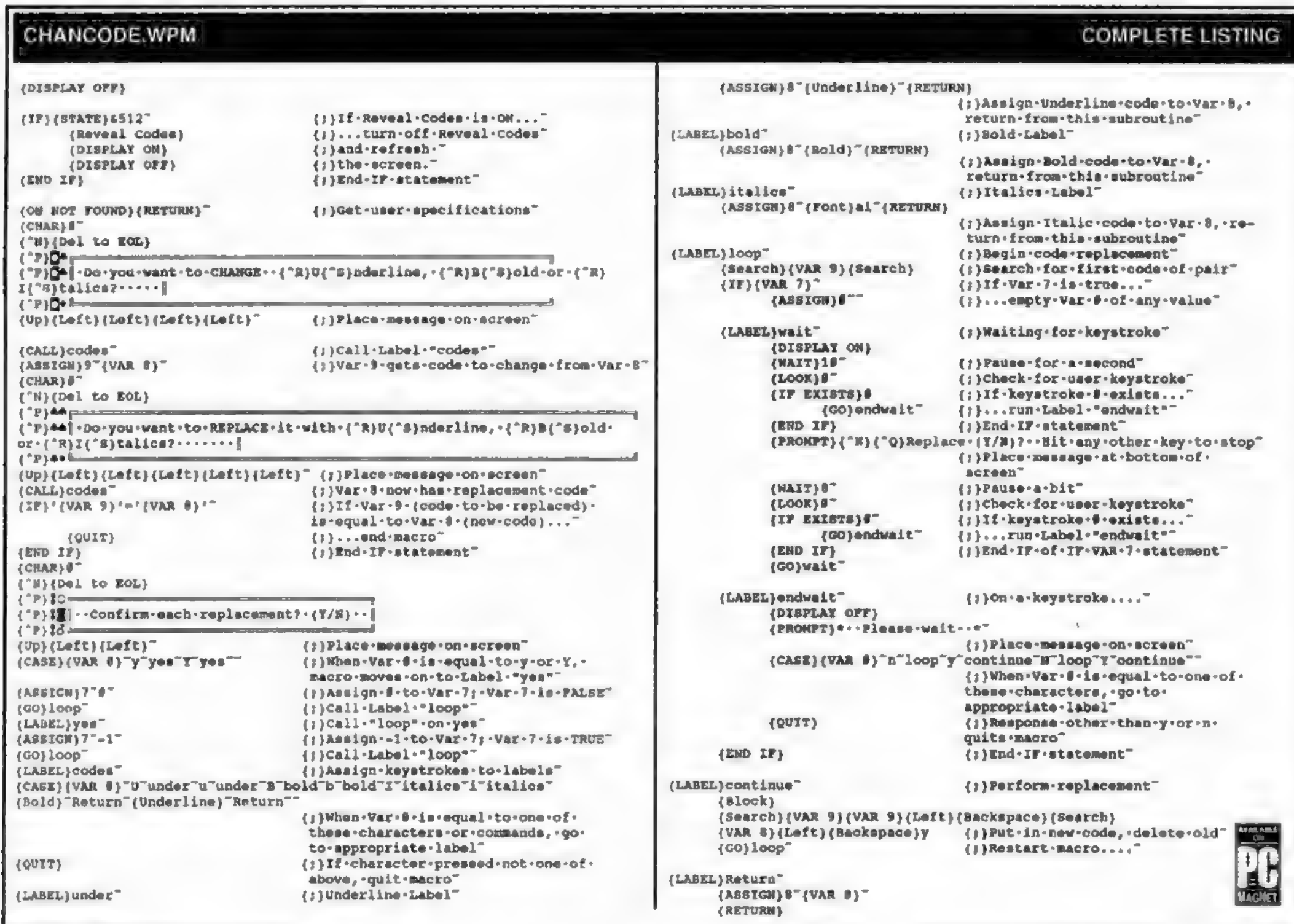


Figure 1: This macro lets you replace one of three attributes (bold, underline, or italic) with any one of the other two and then lets you confirm the change. It depends on user input to determine which attributes are to be searched for and replaced with the others.

CODE looks for a beginning code, blocks all the text up to the end code, turns on the new attribute for the block, and then deletes the beginning code of the original attribute. The macro depends on user input to determine which codes are to be searched for and replaced with others.

In the first step, the macro supplies you with a list of attributes that can be changed: bold, italic, and underline. If you respond with a B, I, or U, the macro jumps to the CODE label; if you tap any other key, the macro quits. The CODE label assigns the B, I, or U keystroke to the BOLD, ITALIC, or UNDERLINE label, which in turn assigns the appropriate code to Variable 8. The value of Variable 8 is then transferred to Variable 9, and a new message asking if you want to replace the old code with bold, italic, or underline is popped up on the screen. Again, after you select an attribute, the CODE label is called, and

the appropriate code is assigned to Variable 8.

At this point the old code has been

**CHANCODE is a
macro that lets you
replace paired codes
in WordPerfect.**

assigned to Variable 9 and the replacement code to Variable 8. If you've chosen to replace an old code with an identical code, the macro quits. Otherwise, you're asked if you wish to confirm each replacement. Pressing Y or y will call the YES label YES. This jumps you to the LOOP

label, which asks you whether you want to replace or to go on at each instance of the unwanted code. After the last old code is replaced, the macro ends. If you choose N or n, the macro also goes to the LOOP label. However, now the replacement is automatic. If you answer the Confirm prompt with any character other than the four noted, the macro quits.

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by
Neil J. Rubenking

User-to-User

BATCH FILE TECHNIQUES

I enjoyed the discussion of repetitive looping in batch files in the February 13, 1990, issue. I want to propose a fast loop mechanism for batch files that *doesn't* require an external program. See the program MKLOOP.BAT (Figure 1), which demonstrates three cases: loops that repeat 9 times, 39 times, and 119 times.

Through this program, I'd like to suggest some techniques that are useful for program readability and compatibility:

- Use lowercase letters.
- Make a program compatible with older versions of DOS (see Figure 2).
- Use undefined environment variables as keywords for comments, for example, %then%, %else%, %begin%, %end%.
- Use the piping symbol (|) as a command separator—you can then use multiple commands per line:

```
cmd1 | cmd2 | ... | cmdn
```

Note that none of the commands except the last may send any output to DOS standard output. If any of the commands is a SET command, don't insert a space before the piping symbol. It will be interpreted as part of the SET string. Instead, put the piping symbol immediately after the end of the set string:

```
Set var=one| set name=| ...
```

- Use if-then-else instead of GOTO:

```
IF '%1'==' ' %then% ... | ... | ...  
%else% ... | ... | ...
```

- Use the tab character for indention; never use consecutive spaces.

Shun Kinoshita
Kawasaki-shi, Japan

 You should examine this system. I can't recommend it for everyone, but there are some wild possibilities in it. First, my comments:

- Lowercase letters—Obviously, this is

■ **BATCH FILE TECHNIQUES:** These formatting techniques make batch files look like high-level language programs.

a matter of personal preference. My own style is to use capital letters for filenames and batch commands, and lowercase or mixed case for environment variables.

■ **Compatibility**—This is the first clever solution I've seen for the problem of using batch files containing @ECHO OFF on multiple machines using different DOS versions. The left column of the chart in Figure 2 shows the construct you should use within your batch files, and the other two columns show SET commands that you must include in the AUTOEXEC of each machine, choosing the one that corresponds to the DOS version on that machine. If your batch file begins with the line %@@ECHO OFF, it will be interpreted as @ECHO OFF on the DOS 3.3

and later machines, so you won't have to see the initial ECHO OFF line on-screen. On the pre-DOS 3.3 machines (which don't support the @ symbol for hiding lines in batch files) it will be interpreted as a simple ECHO OFF.

I'm less enthusiastic about wholesale replacement of CALL with COMMAND /C. There's an important difference between these two constructs. When you use CALL to execute another batch file, any changes the other file makes in the environment remain effective after the CALL. Hence you can use environment variables to pass back results. But if you execute a batch file using a secondary command processor, all changes to the environment are lost upon return to the calling batch file. One possible solution would be to define another variable CALLE, for "CALL with Environment." In DOS 3.3 and later, you'd set it equal to CALL. In other versions of DOS, you'd have it transfer control to a warning batch file that simply tells you that the batch file you were trying to use required DOS 3.3 or later. Then use %CALLE% for any batch file call that really needs the CALL command, and %CALL% when COM-

```

MKLOOP.BAT
1 OF 2
%@@echo off
:
: <<<<< mkloop.bat >>>>>
:
:      echo [example-1] (9 times loop)
:
:      set c1=
:loop1
:      set c1=%c1%-
:
: *loop body*
:      echo *%c1%*
:
:      if not "%c1%"=="-----" %then% goto loop1
:      %else% set c1=
:
:      echo [example-2] (39 times loop)
:
:      set c2=| set c1=
:loop2
:      set c1=%c1%-
:

```

Figure 1: Unusual formatting makes this batch file look like high-level language source code.

MKLOOP.BAT2 OF 2

```
: *loop body*
echo %c2% %c1%
:
  if "%c2%c1%"=="++-----" %then% goto exit2
  %else% if not "%c1%"=="-----" %then% goto loop2
          %else% set c2=%c2%| set c1=
                  goto loop2
:exit2
set c3=| set c2=| set c1=
echo [example-3] (119 times loop)
:
set c3=| set c2=| set c1=
:loop3
set c1=%c1%-
:
: *loop body*
echo %c3% %c2% %c1%
:
  if "%c3%c2%c1%"=="+/+-----" %then% goto exit3
  %else% if not "%c1%"=="-----" %then% goto loop3
          %else% set c2=%c2%| set c1=
                  if not "%c2%"=="+++++++" %then% goto loop3
                  %else% set c3=%c3%| set c2=
                          goto loop3
:exit3
set c3=| set c2=| set c1=
echo *done*
quit
```

THAT
THEOTHER
GOTO exit
:bar
TOM
DICK
HARRY
GOTO exit

can be reduced to this:

```
IF '%1'=='foo' %then% THIS | THAT
| THEOTHER | GOTO exit
%else% IF '%1'=='bar' %then% TOM |
DICK | HARRY | GOTO exit
%else% GOTO error
```

Amazing! Of course, it assumes that there's no interaction between the DOS standard output of one program and the DOS standard input of the next in line.

■ Indention—Again, this is another matter of personal taste.

The MKLOOP.BAT program, shown in Figure 1, is a clever variation on a simple method for counting in batch files. The method is simply to append a character to an environment variable each time through a loop and quit when the variable has reached a certain length. MKLOOP extends that method by providing separate counters for the ones, tens, and hundreds places. You could extend this technique to still larger numbers, until the comparison line, for example

```
if "%c3%c2%c1%"=="+/+-----"
%then% goto exit3
```

becomes longer than a DOS command line.

You'll note that this file does *not* look like a normal batch file, but rather like a high-level language file. Part of the resemblance is the window-dressing of the nonfunctional comments %then%, %else%, %begin%, and so on. But the technique of piling multiple commands on a single line is effective! I expect to see more batch files using this technique.

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MAND /C would be acceptable.

- Keyword comments—This can be quite handy, as long as you remember that these comments have *no* meaning to the batch file interpreter. They are eliminated from the line when the batch processor evaluates environment variables.
- Multicommands per line—It's not entirely true that no command before the last can send anything to DOS Standard Output. The problem occurs only when a command does that and the *following* command gets input from DOS standard input. Also, if you redirect a command's output to a file, that output won't be passed along to the next command. I haven't fully absorbed the possibilities of this technique, but they seem amazing.

- If-then-else—This is really just a simple corollary of using multiple commands on a line. Note that in order for it to work, the %then% line must end with a GOTO command that skips the %else% line. That being the case, it seems odd that the author recommends avoiding GOTO. I assume he means that you can cut down on its use with this technique.

Disregarding the %else% clause, it can be *very* handy to stick several commands on an IF line. For example, these lines:

```
IF '%1'=='foo' GOTO foo
IF '%1'=='bar' GOTO bar
GOTO error
:foo
THIS
```

 MAKING BATCH FILES COMPATIBLE	DOS 3.3 or later	DOS before 3.3
	%@%echo off	set @=@
%call%	set call=call	set call=%comspec% /C

Figure 2: This chart shows a clever solution to the problem of using batch files on multiple machines running different versions of DOS.

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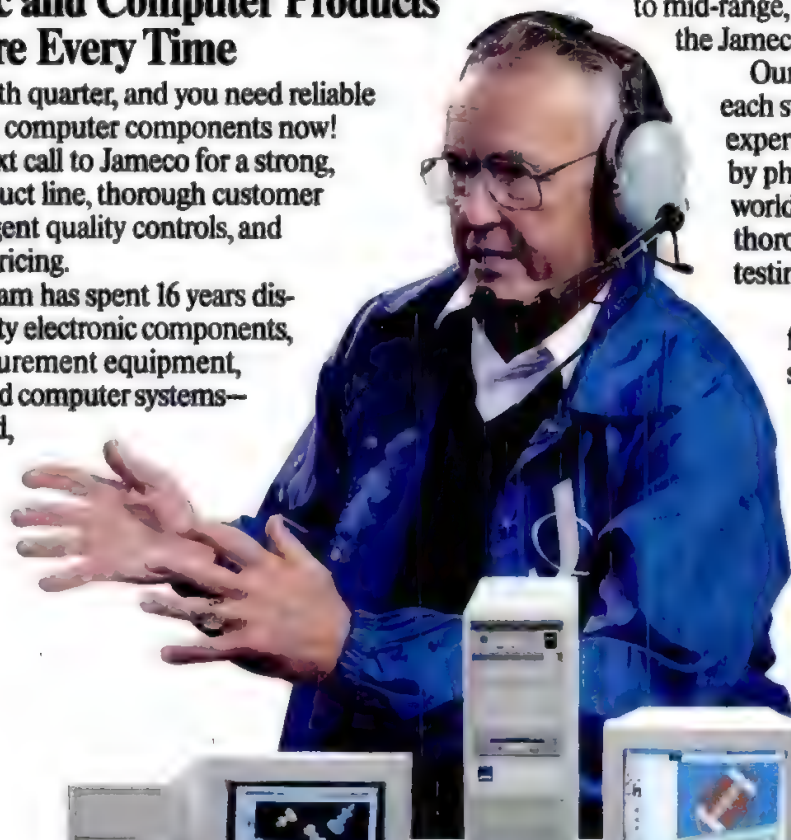
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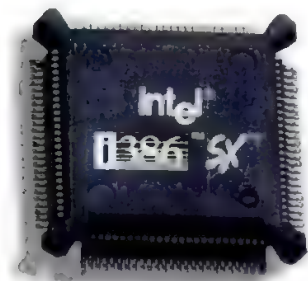


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Instead of compromising comfort by altering the keyboard, the PS/2 Laptop has a full-size keyboard spaced and arranged the same way as a desktop PS/2's. And instead of squeezing information onto a pint-size screen, it has a sidelit LCD that offers a 10 $\frac{1}{2}$ -diagonal viewing area. It delivers sharp, clear text and graphics with VGA quality in 32 shades of gray. With so much to offer, the PS/2 Laptop succeeds at being small, without being small-minded.

THE PS/2 LAPTOP IS ONE LAPTOP NOT TO BE TAKEN LIGHTLY.

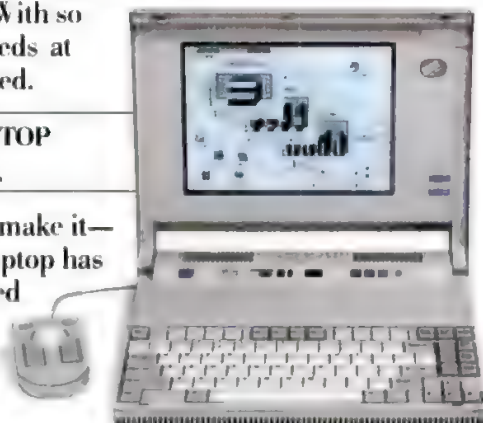
IBM knows it's not how small you make it—it's how you make it small. The PS/2 Laptop has system status icons that monitor assorted functions and battery life. Extensive power management controls include the ability to change batteries in the

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Clock Speed	
MEMORY	2MB
Standard	18MB
Maximum	
STORAGE	
Standard Diskette Drive	3.5" 1.44MB Diskette Drive
Standard Hard Drive	2.5" 60MB Fixed Disk
PACKAGING	
Dimensions	21" (H) x 12 8" (W) x 10 7" (D)
Weight	7.7 Lbs. W/Battery
POWER	
Battery	Up to 3 Hours, W/ Non-Disruptive Exchange, W/ Battery Status Indicator
KEYBOARD	
	101 Keys (W/ Numeric Keypad), 5 Degree Slant, Standard Key Spacing
DISPLAY	
	LCD/Sidelit, VGA/32 Gray Scale
OPTIONS	
	Data/Fax Modem, Trackpoint (Mouse/Track Ball), Quick Charger

middle of an application without exiting and a special feature that suspends power when the screen is closed, then returns to full power when reopened, resuming applications where they were left off without the need to save to the hard drive.

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edited by
Trudy Neuhaus

Languages

A POWER FUNCTION FOR PASCAL

In the age of pocket calculators, I've become lazy: I expect my calculator to calculate 3^2 as well as the fifth root of 1,099. Most scientific calculators have a y^x button to calculate power equations (if the base is greater than zero). However, computer languages such as Pascal don't provide a direct way to do this. They require you to use logarithms and obtain the answer the old-fashioned way. Namely,

Base b to the power $p = e^{(p \cdot \ln(b))}$

in which e is a constant (2.71828...) and $\ln(b)$ is the natural logarithm of b . p can be any real number: If $p > 1$ you obtain the squared, third, and so on, powers; if $0 < p < 1$ you obtain square, third, and so on, roots (for example, $4^{0.5} = \sqrt{4}$, $27^{(1/3)} = 3\sqrt[3]{27}$); if $p < 0$ you obtain the inverse power function (for example, $3^{-2} = (1/3)^2$).

This function can be calculated in any programming language, as long as it provides the $\ln(x)$ (sometimes called $\text{LOG}(x)$) and the e^x (mostly called $\text{EXP}(x)$) functions. Thus, in Turbo Pascal the above formula translates into

Base b to the power $p =$
`Exp(p*ln(b))`

Because you can only take the natural logarithm of positive numbers, this function works only if $\text{base} > 0$. The function in Figure 1A takes this into account and prints an error message when $\text{base} \leq 0$. It will return 0, even though the actual answer is negative infinity. POWEXMPL.PAS (Figure 1B) shows how it's used.

Rogier Gruys
Spirit River, Alberta, Canada



Niklaus Wirth apparently felt that the Pascal language did not need an exponentiation operator. That decision has vexed users of the Pascal language ever since, and the topic comes up

■ A POWER FUNCTION FOR PASCAL: Here's a function to handle all combinations of base and exponent calculations.

again and again. But perhaps he had reasons for omitting the function; its many

special cases can cloud the issue. Still, it's possible to code a function that handles all the possibilities, as you can see in Figure 2. This function handles the special cases and sets an error argument if the combination of base and exponent is invalid.

The first special cases involve a base or exponent of 0. Of course, 0 to any power is 0, so if the base is 0, we return 0 and quit. Any number to the 0 power is 1, so if the base wasn't 0 but the exponent is, the function returns 1 and quits. Note that

POW.PAS AND POWEXMPL.PAS

COMPLETE LISTING

(A) POW.PAS

```
{SN+,E+}
UNIT Pow;
(**) Interface (**)

    FUNCTION Power(base, expon:Double):double;

(**) Implementation (**)

    FUNCTION Power(base, expon:Double):double;
    BEGIN
        IF base <= 0 THEN
            BEGIN
                WriteLn('*** WARNING *** base must be greater than zero');
                power := 0;
            END
        ELSE
            Power := Exp(expon*ln(base));
        END;
    END.
```

(B) POWEXMPL.PAS

```
{SN+,E+}
PROGRAM PowerExample;
USES Crt, Pow;

VAR
    x, expon, base : Double;
    answer : Char;

BEGIN
    ClrScr;
    REPEAT
        Write('Enter a base: ');
        ReadLn(base);
        Write('Enter an exponent: ');
        ReadLn(expon);

        x:=power(base,expon);

        WriteLn(base:5:4,'^',expon:5:4,' = ',x:7:4);
        Write('Press Q to quit, any other key to continue');
        answer := UpCase(ReadKey);
        WriteLn(answer);
    UNTIL answer = 'Q';
END.
```

Figure 1: Turbo Pascal doesn't include a power function, but POW.PAS provides one (that works as long as the base is greater than zero). POWEXMPL.PAS tests this POW Unit.

POWER.PAS

COMPLETE LISTING



```
{SN+,E+}
PROGRAM Power;
CONST epsilon = 1E-4999;

FUNCTION Pow(Base, Expo : Extended;
             VAR error : Boolean) : Extended;

    FUNCTION IsInt(num : Extended) : Boolean;
    BEGIN
        IsInt := ((Abs(Frac(num)) < epsilon) OR
                  (1.0 - Abs(Frac(num)) < epsilon)) AND
                  (Abs(num) < MaxLongInt);
    END;

    FUNCTION SignFix(num : LongInt) : ShortInt;
    BEGIN
        IF odd(num) THEN SignFix := -1
        ELSE SignFix := 1;
    END;

BEGIN
    Error := FALSE;
    IF Abs(Base) < epsilon THEN {BASE = 0}
    BEGIN
        Pow := 0;
        Exit;
    END;

    IF Abs(Expo) < epsilon THEN {EXPO = 0}
    BEGIN
        Pow := 1;
        Exit;
    END;

    IF Base > 0 THEN {BASE positive}
        Pow := Exp(expo * ln(base))
    ELSE
        BEGIN {BASE negative}
            IF IsInt(Expo) THEN {EXPO integer}
            BEGIN
                Pow := Exp(expo * ln(-base)) *
                       SignFix(round(Expo));
            END
        ELSE
            BEGIN {EXPO non-integer}
                Error := TRUE;
                Pow := 0;
            END;
        END;
    END;

    Error := TRUE;
    Pow := 0;
END;

VAR
    B, E, R : Extended;
    Err : Boolean;
CONST
    IsErr : ARRAY[boolean] OF String[7] =
        ('OK', 'ERROR*');
BEGIN
    WriteLn('Enter 0 for both operands to quit. ');
    REPEAT
        Write('Base: '); ReadLn(B);
        Write('Expo: '); ReadLn(E);
        R := Pow(B, E, Err);
        WriteLn(IsErr[Err], ' ', R:30:10);
    UNTIL (B = 0) AND (E = 0);
END.
```

Figure 2: The Power function in this program handles all combinations of base and exponent.

0 is technically undefined, but this function just returns 0. If you find an application in which this is a problem, simply modify the function to set the Error argument to True when both base and exponent are 0.

Note that the function doesn't actually test whether the arguments are equal to 0. Testing for equality is never safe when using floating-point numbers, because the floating-point representation of most numbers is only an approximation. The

function tests whether the absolute value of the number is less than an arbitrary constant, epsilon. If it is, the function assumes the number is intended to be 0. Unfortunately, there's no hard-and-fast rule for choosing the value of epsilon, and a different value will be required for floating-point types with different ranges.

If neither base nor exponent is 0, there are two main possibilities; the base is positive or it's negative. If the base is positive, the function can use the same formula the simpler power function does. But if the base is negative, the power function is undefined *unless* the exponent is an integer. Actually, taking a noninteger power of a negative number yields an *imaginary* number, but we're not dealing with those here.

The IsInt function determines whether or not the exponent is an integer. It uses the built-in Frac function, which returns the fractional part of a floating-point number. If Frac returns 0, you can be fairly sure the number is an integer. That's half right. If the fractional part is almost exactly equal to one, you can also assume the number is an integer. Round-off error might have added a tiny amount to the number, in which case Frac would be near 0, or it might have subtracted a tiny amount, so Frac would be near 1.

When calculating integer powers of negative numbers, it's essential to know whether the exponent is even or odd. Even exponents produce positive results; odd, negative. Unfortunately, when floating-point numbers become large, the accuracy in the lowest digits is lost. One way to accurately determine whether a number is even or odd is to restrict it to the range of a LongInt, and that's just what the final condition of the IsInt function does.

It's very common to see power functions that use the exponential and logarithmic functions to compute powers. I hope you'll find this *safe* power function still more useful.—Neil J. Rubenking

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by
Jeff Prosize

Tutor

A BETTER COMMAND LINE

After almost a year of beta testing and months fine-tuning the software and working out the bugs, the new apple of Microsoft's eye is finally on display for public scrutiny. In all likelihood, it will be the most popular version of DOS ever, thanks to a whole assortment of new and improved commands and utilities that make other versions of DOS simply pale in comparison.

One of the most exciting utilities making its debut in DOS 5.0 is DOSKEY. DOSKEY adds several long-awaited features to the command line, including the ability to recall past commands, edit commands, string multiple commands together, and create command macros. The utility is similar to third-party command-line enhancers that have flourished in recent years, like Chris Dunford's CED and *PC Magazine's* own DOSKEY and ALIAS utilities. This installment of Tutor will give you a guided tour of the new DOSKEY and demonstrate just a few of the ways you can put it to work on your system.

INSTALLING DOSKEY

Before you try out the examples presented here, you'll need to install DOSKEY. You can load the small RAM-resident utility in any of four ways: with an INSTALL directive in CONFIG.SYS, from the command line, from your AUTOEXEC.BAT, or (if you have a 386 with at least 1MB of memory) with DOS 5.0's new LOADHIGH command.

There's an advantage to using LOADHIGH: The program will be loaded into the area of memory between 640K and 1MB, leaving conventional memory for transient applications. In DOS 5.0 this region is called the Upper Memory Area, and the blocks of memory that programs are loaded into above 640K are called *Upper Memory Blocks*, or UMBs. (Note that before you can use LOADHIGH, you must load the device drivers HIMEM.SYS and EMM386.EXE and boot with the

■ **A BETTER COMMAND LINE: DOS 5.0's exciting new DOSKEY utility adds much-needed features to the DOS command line.**

statement DOS=UMB in CONFIG.SYS.)

To load it, type DOSKEY at the DOS prompt. You'll immediately notice a few differences in the way DOS behaves on the command line. For starters, enter a few commands—any commands. Then press the Up Arrow key a few times. You should see each of the commands you entered displayed before you. This feature is called *command recall*; it lets you recall and rerun old commands so you don't waste time typing them over again. Just as Up Arrow works backward through the command stack, Down Arrow works forward, allowing you to work your way back to the top of the stack if you overshoot the command you're looking for. When you find a command you want to execute, press Enter.

To see a list of commands recorded in the command stack, type

```
DOSKEY /HISTORY
```

The maximum number of commands DOSKEY will remember depends on three things: the length of the commands, the number (and length) of the command macros defined (I'll discuss command macros shortly), and the buffer size you install DOSKEY with. By default, DOSKEY reserves 512 bytes for recording all commands and macros. If you want it to record more commands, or if you want to reserve additional buffer space for storing macros later on, use the /BUFSIZE switch to increase the buffer size. The command

```
DOSKEY /BUFSIZE=2048
```

installs DOSKEY with a 2K buffer. If you install DOSKEY with LOADHIGH and have plenty of upper memory to spare, you may decide to increase the buffer size even more, to make use of some of this extra memory.

If the command stack grows very large, it may be difficult to locate a particular command. Fortunately, cycling through the stack one command at a time with the Up or Down Arrow isn't the only way to search out a particular command. The first method involves picking the desired command from a numbered list. To illustrate, press F7. DOSKEY will respond with a command list like the one it displayed when you used the /HISTORY switch, but this time the commands are numbered.

To execute a particular command, press F9, type the command number, and press Enter again. The command will be redisplayed on the command line, and you can execute it by hitting Enter. The second method is easier still. I like to call this DOSKEY's *smart search*. Let's say you want to recall a COPY command that you issued a while back, and you know it's going to take a little effort to locate. To find it quickly, type COPY on the command line and press F8. The last COPY command you executed will be recalled. Press F8 again and the next-to-last one will be recalled, and so on, until you've cycled through all the COPY commands you entered.

F8 recalls only commands that match the template you enter on the command line. Enter as much or as little text as you want; the more you enter, the more selective DOSKEY will be.

You can recall the oldest command in the command stack with the PgUp key, or the most recent one with PgDn. You can also clear the stack of all recorded commands by pressing Alt-F7. Figure 1 lists all the command recall keys that DOSKEY recognizes.

With DOSKEY installed, you may now execute two or more commands from

the same command line by separating the commands with Ctrl-T. A paragraph marker (§) appears when you type Ctrl-T. The command

```
DEL *.DOC&DIR
```

deletes files with the extension .DOC from the current directory and executes a DIR command to show the results. You may string together as many commands as the 127-character limit on the length of the command line will allow.

COMMAND EDITING

In addition to letting you recall past commands, DOSKEY also lets you edit them. To illustrate, type the command

```
DOSKEY /BUFSIZE=2048 /REINSTALL
```

but don't press Enter. Instead, press the Left Arrow key a few times. Rather than rubbing out characters as it moves to the left, the cursor now moves non-destructively. You can also move the cursor with the Right Arrow key, the Home key, or the End key, and with the Left and Right Arrow keys shifted with Ctrl. End moves to the end of the line; Home moves to the beginning; Ctrl-Left moves to the beginning of the word on the left; and Ctrl-Right moves to the beginning of the word on the right.

You can replace characters in a command by typing over them or insert text by toggling DOSKEY into insert mode with the Ins key. DOSKEY enlarges the cursor in insert mode so that it's obvious what mode you're in. Once you press Enter to

Figure 2: If you make a mistake or change your mind, you can use these keys to edit the DOS command line.

execute a command, DOSKEY automatically returns to the default text-insertion mode for the next command. You can specify what that default should be when you install DOSKEY by typing

```
DOSKEY /INSERT
```

to make insert mode the default, or

```
DOSKEY /OVERSTRIKE
```

to make overstrike mode the default. If you don't specify either, DOSKEY defaults to /OVERSTRIKE. Note that the cursor can be anywhere on the command line when you press Enter to execute a command; it doesn't have to be at the end.

There are now four keys or key combinations that delete text from the command line: Delete, Backspace, Ctrl-Home, and Ctrl-End. Delete erases the character at the cursor and draws text in from the right; Backspace deletes the character left of the

cursor and also draws text in from the right; Ctrl-Home deletes everything from the character immediately left of the cursor to the beginning of the line; and Ctrl-End deletes everything from the cursor to the end of the line. In addition, Esc now clears the entire command line.

Figure 2 lists all the command-editing keys DOSKEY puts at your disposal. It doesn't list function keys F1 through F6, which work the way they did in previous versions of DOS. The only difference in DOSKEY's handling of these keys is that when you recall a command from the command stack it updates the command template—the unseen pattern of characters that F1 through F5 use as an editing guide—to reflect the most recent command.

COMMAND MACROS

DOSKEY also permits you to create command macros that combine one or more DOS commands into one easy-to-type command whose name you choose. You can demonstrate this by typing

```
DOSKEY LS=DIR /O:N
```

This command creates a macro called LS that executes a DIR /O:N command (/O:N, new in DOS 5.0, outputs directory listings sorted alphabetically). Now type LS; you should get a sorted listing showing the contents of the current directory. If you want to delete the macro, enter

```
DOSKEY LS=
```

Figure 1: Use these keys to recall and rerun old commands so that you don't waste time typing them over again.



DOSKEY'S COMMAND-EDITING KEYS

KEY(S)	DESCRIPTION
Left Arrow	Moves the cursor one character to the left
Right Arrow	Moves the cursor one character to the right
Home	Moves the cursor to the beginning of the line
End	Moves the cursor to the end of the line
Ctrl-Left	Moves the cursor to the beginning of the word on the left
Ctrl-Right	Moves the cursor to the beginning of the word on the right
Del	Deletes the character at the cursor
Backspace	Deletes the character left of the cursor
Ctrl-Home	Deletes everything from the character left of the cursor to the beginning of the line
Ctrl-End	Deletes everything from the cursor to the end of the line
Ins	Toggles between insert and overstrike mode
Esc	Clears the command line



DOSKEY'S COMMAND RECALL KEYS

KEY(S)	DESCRIPTION
Up Arrow	Recalls the last command in the command stack
Down Arrow	Recalls the next command in the command stack
PgUp	Recalls the oldest command in the stack
PgDn	Recalls the most recent command in the stack
Alt-F7	Clears the command stack
F7	Displays a numbered list of commands
F8	Recalls the last command that matches the text already entered on the command line
F9	Executes a command by number (see F7)

Tutor

the command line with a \$T character. The \$T replaces the Ctrl-T you'd type if you were just combining commands, not creating a macro. The command

```
DOSKEY MCD=MD $1 $T CD $1
```

creates a macro called MCD that creates a new subdirectory and switches to it. After, the command

```
MCD \TMP
```

creates TMP as a descendant of the root directory and executes a CD command to make \TMP the current directory. The \$1 symbol in the command that created the macro is analogous to %1 in a batch file; DOS replaces it with the first parameter entered after the macro name. Macros can access up to nine different command-line parameters this way (\$1 through \$9). Furthermore, the symbol \$* stands in for all the parameters entered on the command line. There's no equivalent of the SHIFT command for macros.

Figure 3 lists all the macro definition symbols that DOSKEY recognizes. To build a macro that uses redirection or piping, use the symbols \$G, \$L, and \$B in place of output redirection, input redirection, and piping operators. For example, the command

```
DOSKEY TY=TYPE $1 $G MORE
```

creates a TY command that is identical to TYPE except that it automatically redirects output to the MORE filter. Don't use the familiar >, <, or | redirection symbols when creating a macro; DOS will misinterpret your intentions and perform the

redirection on the command that creates the macro.

Macros assigned the same name as internal DOS commands will take precedence over those commands, effectively replacing them. You can use this to your advantage in several ways. For example, if you frequently find yourself in trouble as a consequence of using DEL with wildcard characters, try this macro:

```
DOSKEY DEL=DEL $1 /P
```

Now a /P switch is automatically appended to DEL, so you'll be prompted for confirmation before each file is deleted. Similarly, if you have a favorite screen-clearing utility called CLRSCR that sets the screen colors the way you want them, make sure CLRSCR is in your current PATH, and type

```
DOSKEY CLS=CLRSCR
```

Thereafter, typing CLS will invoke CLRSCR rather than the screen-clearing logic inside COMMAND.COM.

In DOS 5.0, a switch (/S) added to the DIR command searches descendant directories in addition to the specified or default directory. Use this switch in a macro to create a WHEREIS utility that will locate a file anywhere on-disk. First type

```
DOSKEY WHEREIS=DIR \ $1 /S
```

Now the command

```
WHEREIS BUDGET.DOC
```

will search every directory on the default drive for BUDGET.DOC and report all occurrences, while the command

```
WHEREIS BUDGET.DOC D:
```

will search every directory on drive D:. You can get a list of all the macros defined for the system by typing

```
DOSKEY /MACROS
```

In fact, this provides a convenient mechanism for saving all the currently defined macros to a file so that you can re-create them later. Type

```
DOSKEY /MACROS > MACROS.BAT
```

to copy all of them to a file named MACROS.BAT, then use a text editor to insert the word DOSKEY at the start of each line in the file. Now you have a batch file that will re-create the macros for you. At present, this is the only mechanism DOS provides for saving macros. You can delete all the macros currently defined for the system in one swoop by pressing Alt-F10.

JUST THE BEGINNING

DOSKEY is just one of many new commands and utilities you'll find in DOS 5.0 that make life with DOS a little bit easier. If you haven't upgraded to DOS 5.0 yet, don't wait much longer; the cost of upgrading will pay for itself many times over in reduced typing time alone. In the next column, we'll take a look at two more new commands that help make DOS 5.0 the most powerful version of DOS yet. These are LOADHIGH and DEVICEHIGH, which let you load TSRs and device drivers into memory between 640K and 1MB on 386 and 486 systems. After that, you're sure to have questions of your own about DOS 5.0, so Tutor will return to its customary question-and-answer format.

ASK THE TUTOR

The Tutor solves practical problems and explains techniques for using your hardware and software more productively. Questions about DOS and systems in general are answered here. Write to Tutor, PC Magazine, One Park Avenue, New York, NY 10016, or upload your submission to PC MagNet (see the PC MagNet News page following the Utilities column for instructions). We regret that we cannot answer questions individually. ■

Jeff Prosis is the author of a new book, PC Magazine DOS 5 Techniques and Utilities, published by Ziff-Davis Press (ISBN 1-56276-007-6).—Ed.

SPECIAL DOSKEY MACRO-DEFINITION SYMBOLS	
SB	Piping operator ()
\$G	Output redirection operator (>)
\$L	Input redirection operator (<)
\$T	Command separator
\$1-\$9	Replaceable command-line parameters
\$*	All parameters entered on the command line
\$	Dollar sign (\$)

Figure 3: These symbols let you combine several DOS commands into a single easy-to-type command macro.

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CIRCLE 367 ON READER SERVICE CARD



by
Frank J. Derfler, Jr.

Connectivity

THE RIGHT CONNECTION

Our 10BaseT wiring worked fine when it was first installed, but lately we've been developing problems. The cure seems to be to cut off the old connector and install a new one. Is this common?

Tom McLeod
Atlanta, Georgia



The unshielded twisted-pair wiring scheme is very popular for 4-megabit-per-second Token-Ring networks and for Ethernet (the IEEE 10BaseT standard). I've previously stated in this column that I don't recommend using unshielded twisted-pair wiring for Token-Ring installations, but I'll acknowledge that many organizations use this combination without problems. The 10BaseT systems seem to have fewer problems over time than unshielded twisted-pair wiring carrying Token-Ring.

No matter how you plan to use unshielded twisted-pair wiring, the best decision you can make is to hire an experienced and reputable contractor to install it. The job seems simple, and with proper training and equipment it is, but there are many potential problem areas.

The lowly RJ-45 connector is a frequent cause of delayed twisted-pair wiring problems. There are different kinds of RJ-45 connectors and installers get them confused. RJ-45 connectors designed for solid wire have two prongs that *straddle* the wire when the connector is crimped down, while the connectors designed for stranded wire actually *pierce* the wire strands when crimped.

Unfortunately, installers sometimes place the connectors for stranded wire on solid wire, and this causes the sort of problem you describe. When first installed, these connections test out perfectly. The connectors bend up against the solid wire and make electrical contact, but after a few moves or the passage of time, this unstable contact becomes open, or even worse, intermittent.

A good way to test suspect connectors

■ **THE RIGHT CONNECTION:** Preventing future wiring problems.

■ **STOPPING RETRANSMISSIONS:** Packets within packets within packets make for slow data transmission.

■ **COURSES OR TRADE SHOWS:** Getting the best value for your training dollars.

■ **MORE HELP ON NETBIOS:** Another good reference for programmers.

■ **AUTOMATING DATA ACCESS:** How to get your data when you're not around.

is with a cable tester such as the Quick Scanner from Microtest. It has an eight-wire test mode that shows if and how each wire is connected. To detect problems, you run the test and jiggle the connectors and wires. Contact Microtest at 800-526-9675 for more information.

STOPPING RETRANSMISSIONS

I'm having trouble determining the source of some NetBIOS retransmissions across a network bridge. We have two *NetWare 386*, Version 3.1, Ethernet networks connected with Eicon X.25 bridges. The bridges communicate across a 9.6 kilobit-per-second link. There's a database server on one LAN, and the workstations on the other LAN access the database using Novell's NetBIOS emulator.

A trace of the NetBIOS (as seen from

the bridges) or the X.25 channel shows that NetBIOS packets are being sent three times (two retransmissions at 1-second intervals) from the database server to the workstations, as well as from the workstations to the database server. From the user's point of view everything works fine, but these retransmissions cost time and money because of all the extra traffic.

The only NetBIOS time-out parameters I see are concerned with aborting a session if a particular time is exceeded, none that handle retransmissions. It seems that NetBIOS retransmits because it doesn't receive an acknowledgement fast enough over the relatively slow link, but I don't see where the "retransmit timer" is or how to change it.

Mitchell Shnier
(via CompuServe)



There is no retransmit timer you can change, and that's a shame, because Novell's NetBIOS emulator has little patience with delay.

Did you ever hear the song that begins, "I Know an Old Lady Who Swallowed a Fly"? It's about a person who swallowed an unlikely series of animals. I'm always reminded of that song when I think about the swallowing that goes on as data moves through a multiprotocol communications system. Let's see what's happening across your X.25 link.

First, the NetBIOS emulator takes the input from an application program and puts it into a NetBIOS packet. This packet is encapsulated into an IPX packet, and the IPX packet is then stuffed into an Ethernet packet by the adapter card. Now the bridge strips the IPX packet out of the Ethernet packet but leaves the rest alone. The bridge hardware wraps the IPX packet (with the NetBIOS packet inside) into an X.25 packet and sends the whole package across the relatively slow LAN-to-LAN link. Both the IPX packet and the X.25 packet require an acknowledgement. In your system, there's such a heavy flow of lower-level data packets and ac-

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Connectivity

knowledge packets moving across the link, it's no wonder NetBIOS gets impatient and sends out another request.

At the very least, you should call Eicon and order the software for the Eicon NetBIOS bridge. This product reads the contents of the packet and "spoofs" an acknowledgement to NetBIOS—essentially telling NetBIOS, "I've got it" and assuming responsibility for delivery of the NetBIOS packet. There are other companies, notably Gateway Communications, with products able to send an acknowledgement to IPX and clear that

**Interop forces
vendors to
demonstrate how
their products really
behave in a
multioperating-
system environment.**

stimulus/response chain. Simply by reducing the NetBIOS traffic, you should see a significant improvement in throughput on your 9.6-kilobit link.

COURSES OR TRADE SHOWS

Should I get my company to send me to the Comdex computer show? I'm the administrator of a 50-node *NetWare* LAN and we expect the network to continue to grow. My boss says you can decide whether we should spend the money.

Sally Carlson
San Jose, California



First, you should consider whether the trade show money might not be better spent sending you to some of the excellent courses on *NetWare* provided by Novell and other companies offering certified training. You learn many things in formal training courses that you don't encounter at trade shows.

On the other hand, at the Fall Comdex

show in Las Vegas, you'll find hundreds of displays from the manufacturers of various products, and you'll be able to gather information about alternative sources for adapter cards, printers, modems, and all kinds of other peripherals. The people at the booths will almost always refer you back to dealers for pricing information and sales.

But if you have your heart set on a trade show, I think you'd be better off attending the NetWorld show in Dallas. Some of the smaller and often more interesting networking companies might not make it to Fall Comdex, because the NetWorld show is held just the week before. Companies find it physically tough on their people to do two shows back-to-back, and the logistics of moving booth equipment between the two places so quickly is daunting. Unless you really need information on printers and PCs too, I think you'll get a lot more out of the NetWorld show.

While we're on the subject of trade shows, any of you who are even thinking about using TCP/IP to link LANs or who are interested in LAN/WAN/MAN connectivity should know about the Interop show scheduled to be held in San Jose, California from October 7 to 9, 1991. The show (now owned by *PC Magazine's* parent company) started in 1986 as a small, invitation-only gathering of technical gurus interested in TCP/IP. Interoperability has become a hot topic that interests a wide range of people and last year over 23,000 people attended a show that combined the best of Unix, OSI, frame relay, ISDN, e-mail, distributed computing, and other more esoteric topics.

One of the most important things Interop does is to force vendors to demonstrate how their products really behave in a multioperating-system environment that includes computers with many different architectures. The people who run the show are technologists who spend all year working with companies to make sure their newest products will interoperate. They perform a tremendous and unofficial service to all buyers. Contact Interop at 415-941-3399.

MORE HELP ON NETBIOS

In the April 30, 1991, issue of *PC Magazine*, you suggested Architecture Technology's *Inside NetBIOS* by J. Scott Haugdahl as a good source for information about programming NetBIOS. I would have recommended *C Programmer's Guide to*

Connectivity

NetBIOS by W. David Schwaderer, published by Sams. It's very detailed and has many valuable programming examples.

James Hardy

Mississauga, Ontario, Canada

PC The *C Programmer's Guide to NetBIOS* does provide good hints and examples for would-be NetBIOS programmers. I think Haugdahl's book furnishes a better conceptual explanation of what NetBIOS is and how it evolved, but Schwaderer's book contains more of the kind of information serious C programmers need.

AUTOMATING DATA ACCESS

I have a client who needs to access the PCs in three retail stores after closing and download files from the accounting system. I can write a script file to do this in the scripting language of any of several communications programs, but aren't there some programs that do calling and collecting as their main task? They probably have more features than I want to take the time to put into a script file.

William Walsh

Madison, Wisconsin

PC In the March 27, 1990, issue of *PC Magazine*, I stuck the tag Wide Area Information Transfer Systems (WAITS) on a class of products that do exactly what your client needs. The two leading products in this area are *Xcenenet* and *XChange Plus*. Considering the scale of operation you describe, *XChange Plus* from SofNet sounds like the right product for you. It uses simple fill-in-the-blank schedules for calling instructions, password and security specifications, data encryption, and filename specifications. The package has internal data compression and automatically reschedules calls that don't go through. It lists for \$345 and is able to support both ends of the link. You supply the modems. Contact SofNet at 404-499-0007.

SETTING THE RECORD STRAIGHT

Back in the December 11, 1990, issue of *PC Magazine*, I suggested using Protec Microsystems's Xtendplus to drive signals to a printer as far away as 8,000 feet. The Xtendplus multiplexes the signals

from the parallel printer port onto four-conductor telephone wiring so that you can send jobs to printers located in widely separated areas of a building. Unfortunately, I got the pricing wrong. I assumed you needed to buy two separate units to make the link, but Protec tells me that prices (which start at \$310) include both ends of the link. Protec, located in Quebec, Canada, has a new toll-free number for the United States, 800-363-8156.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay \$50 for any tip we print. Please submit your letter on a disk along with a printout. Then mail your contribution to Connectivity, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named PC MAGAZINE LAN LABS).



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1989, 1990 *Reseller Management* "Best to Sell UPS"

1990, 1991 *LAN Times*, Readers' Choice

1989 *PC Week*, "All Around Reliable Choice"

1990 *Infoworld*, "Value Leader"

1990 *Systems Integration*, Product of the Year

1991 *Byte Magazine*, Best UPS for LANs



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When you're really ready to put DOS 5 to work, visit your favorite bookstore and pick up a copy of *PC Magazine DOS 5 Techniques and Utilities*.

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FastData 386/33 \$1899

The fastest 386 processor available combined with a 64K thirty nanosecond memory cache make the FastData 386/33 a power users dream! Included in the base price is a 105 megabyte 17millisecond hard disk, 1024 by 768 VGA monitor and card, four megabytes of memory, and 5.25" & 3.5" high capacity floppy drives. Plus, should anything ever go wrong with your FastData computer, you are covered by a one-year warranty with free on-site service or system replacement if we cannot correct the problem with our FastSHIP advance parts replacement program.

Standard Features

- ✓ 33mhz Intel 386-DX processor.
- ✓ 64K high-speed memory cache.
- ✓ 4 megabytes high speed RAM.
- ✓ 105 mb 17ms IDE hard disk, 1:1 interleave.
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- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 1mb Video Ram.
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- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion & 5 drive bays.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
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- ✓ Windows & Mouse add \$69.
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386/DX33	80mb	100mb	200mb	660mb
Mono	\$1,529	\$1,599	\$1,849	\$3,199
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VGA 1024ni	\$1,929	\$1,999	\$2,249	\$3,599



FastData 386/25 \$1699

The optimum combination of features, expandability, and power make the FastData 386/25 an ideal choice for those whose applications demand high speed 32 bit processing and expandability. The value of the 386/25 goes far beyond its price; it comes configured with a full four megabytes of fast RAM, a quick 18 millisecond 80 megabyte hard disk, and maximum VGA displaying 1024 by 768 resolution powered by a high-output 16 bit 1mb VGA board. Also, the FastMicro team will configure your FastData 386 exactly the way you want, without sending you shopping elsewhere.

Standard Features

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- ✓ 4 megabytes of high speed RAM.
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- ✓ Standard chassis or mini-tower (shown) with keylock, speed and reset buttons.
- ✓ 80387-DX coprocessor socket.
- ✓ 200 watt power supply.
- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 slots & 5 drive bays.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ MS-DOS 5.0.
- ✓ Windows & Mouse add \$69.
- ✓ FCC Class B approved.

386/DX25	80mb	100mb	200mb	660mb
Mono	\$1,399	\$1,469	\$1,719	\$3,069
Mono VGA	\$1,499	\$1,569	\$1,819	\$3,169
VGA 1024i	\$1,699	\$1,699	\$2,019	\$3,369
VGA 1024ni	\$1,799	\$1,869	\$2,119	\$3,469

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FastData SX Systems



\$1499 FastData SX/20

25% faster than a 16mhz SX, the FastData SX/20 adds even greater performance to its 386 multitasking capabilities. Just \$200 more than our SX/16, this machine also includes an 80mb hard drive in addition to the super VGA color monitor and 16 bit VGA adaptor, Keytronics keyboard, DOS 5.0, and two floppy drives. The system includes two megabytes of memory and is expandable to eight on the main system board. Remember, when you have questions, need to solve a problem, or want recommendations on products for your system, the FastMicro team is standing by toll-free to provide product support for as long as you own your FastData personal computer.

Standard Features

- ✓ 20mhz Intel™ 386-SX processor.
- ✓ 2 megabytes of high speed RAM.
- ✓ 80 mb 18ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard chassis (shown) or mini-tower with keylock, speed and reset buttons.
- ✓ 200 watt power supply
- ✓ 14" Super VGA color monitor with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots, 5 drive bays.
- ✓ 80387-SX coprocessor socket.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$69.
- ✓ MS-DOS 5.0.
- ✓ FCC Class B approved.

386/SX20	40mb	80mb	100mb	200mb
Mono	\$1,069	\$1,199	\$1,269	\$1,519
Mono VGA	\$1,169	\$1,299	\$1,369	\$1,619
VGA Color	\$1,319	\$1,449	\$1,519	\$1,769
VGA 1024i	\$1,369	<u>\$1,499</u>	\$1,569	\$1,819



\$1299 FastData 386/SX

Combine the benefits of an advanced Intel 386 processor, the value of a 286 and the advantages of FastData and you've got the FastData 386/SX! This machine is the choice of those who want to run today's powerful 386 and multitasking software, like Windows, and also want to run their favorite DOS applications at surprising speeds. We've made our customers' favorite options standard: it comes with an ample two megabytes of memory, a high performance 40mb hard drive, and 16 bit super VGA. Compare performance, features, and service and you will find no better SX value. Interested further? Try the FastData 386/SX for 30 days; you have to be happy - if not, we'll take it back.

Standard Features

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- ✓ 2 megabytes of fast RAM.
- ✓ 40 mb 28ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard, mini tower, or mini desktop (shown) chassis with keylock, speed and reset buttons.
- ✓ 200 watt power supply
- ✓ 14" Super VGA color monitor with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and a game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots, 5 drive bays.
- ✓ 80387-SX coprocessor socket.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$69.
- ✓ MS-DOS 5.0.
- ✓ FCC Class B approved.

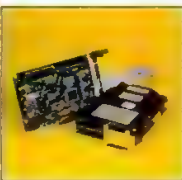
386/SX16	40mb	80mb	100mb	200mb
Mono	\$999	\$1,129	\$1,199	\$1,449
Mono VGA	\$1,099	\$1,229	\$1,299	\$1,549
VGA Color	\$1,249	\$1,379	\$1,449	\$1,699
VGA 1024i	\$1,299	<u>\$1,429</u>	\$1,499	\$1,749

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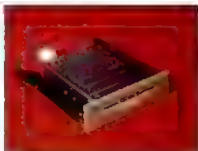


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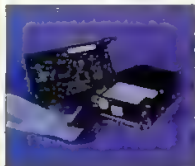
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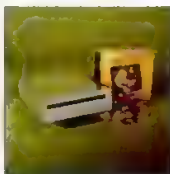
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WDAP4200 200mb IDE 20ms	649
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Sound Blaster does for sound what VGA does for graphics! Supported by the largest software library, Sound Blaster makes your games come to life. Also includes a music synthesizer, voice input and sound compression, and MIDI interface. SB Talker even converts text into spoken English. Includes a game port. As

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Classic 2400 Modem Int. / Ext.	139 / 169
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2400 Sportster MNP Int. / Ext.	159 / 189
Couner HST 14,400 Int. / Ext.	539 / 579
Couner HST 14,400 Dual Standard Ext.	839
Videa 7	
VGA 1024/ 256K / 512K	159 / 189
V-RAM II VGA 512K	339
ZOOM	
HC2400 Internal	69
2400 V.42bis External Modem	159
9624 Send/Receive Internal Fax Modem	119



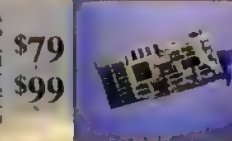
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Diamond Scan 1381	499
NEC	
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Multisync 3d	629
Multisync 4d	949
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Zenith 1492	599

FastData Products

FastData 16 Bit VGA

The FastData 16 bit VGA card features 256K of video memory, does CGA, EGA, & VGA up to 1024x768 and comes with drivers for popular software including Windows 3.1. It's expandable to 512K and has a 30 day money-back guarantee.



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FastData CGA Card	35
FastData MGP Card	29
FastData Parallel Dual Serial Game Card	29



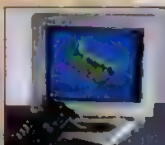
FastData 2400 Band Internal Modem

The FastData 2400 band internal modem is fully Hayes compatible and can be configured to COM port 1-4. It has an internal speaker, is auto answer & auto dial, and comes with communications software.

9600B Send/Fax w. 2400B Modem	99
9600B Send/Receive Fax w. 400B	119
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RLL 1st 1" 1" Hard Floppy Disk Cont.	59
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Citizen GSX-140+ \$299

The new series of the Citizen GSX-140+ comes with 8 resident fonts, paper, parallel, and two color schemes. Hooks up to ECPs and most new enhanced LCD control panel that lets you set everything without DIP switches. Upgrade to color anytime for just \$15.

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KXP1624	379
KXP4420 Laser	829
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Texas Instruments

MicroLaser PS17 \$1199

Postscript laser printing has never been so affordable before. The TI PS17 includes 1.5mb of memory, a minimum Postscript 3.0 Adobe and 1.5 standard fonts including Times Helvetica, Courier and Symbol. It handles paper up to 8.5 x 14 and envelopes too.



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Star	
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NX1500	299
NX2410 / 2415	249 / 369
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Texas Instruments Microlaser PS17	1199
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- ✓ 200 watt power supply.
- ✓ Math coprocessor socket
- ✓ Monochrome monitor with monochrome graphic board.
- ✓ Clock/calendar, parallel port, game port, & 2 serial ports.
- ✓ KeyTronic enhanced 101 keyboard.
- ✓ 8 expansion slots, 6 available.
- ✓ MS-DOS 5.0.
- ✓ Full documentation.
- ✓ FCC Class B approved.



	286/12	40mb	80mb	100mb	200mb
None	None	None	None	None	None
Monochrome	None	None	None	None	None
VGA Color	None	None	None	None	None
VGA 1024	None	None	None	None	None

DATABASE & FORMS

askSam 5.0	209
Avery List & Mail Plus	37
Clanon Personal Developer	45
Clanon Professional Developer	449
Clipper 5.01	489
DataEase	459
dBase III+	439
dBase IV	479
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PFS First Publisher	89



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The Manager's Organizer	139
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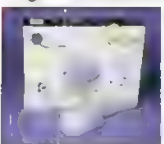
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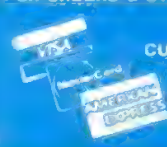
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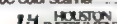
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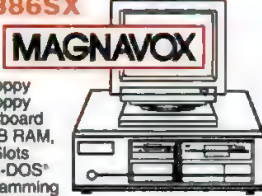
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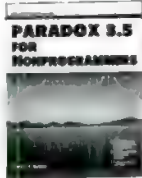
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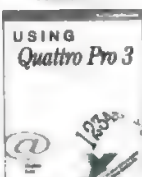
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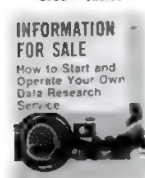
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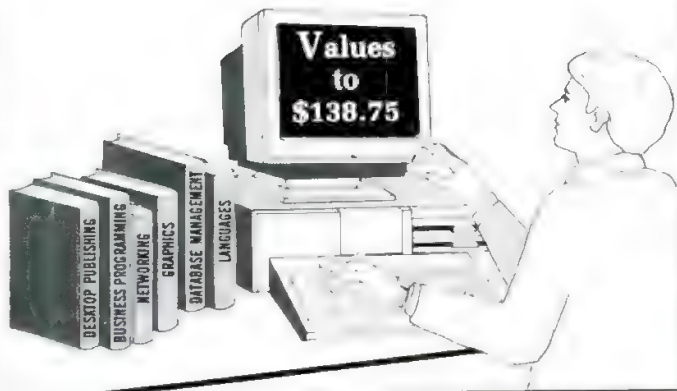
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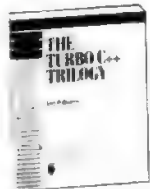
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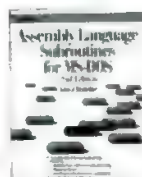
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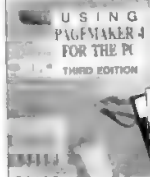
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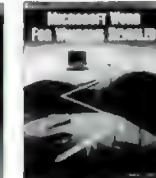
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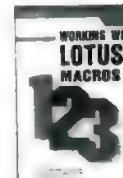
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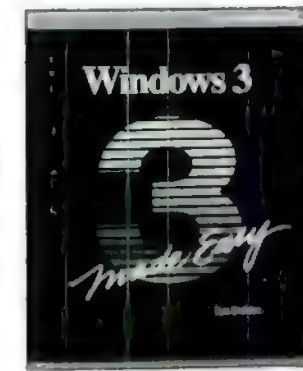
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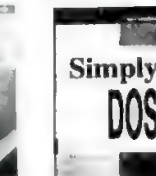
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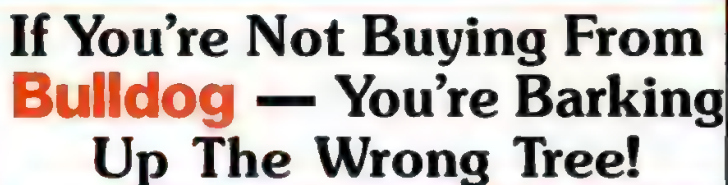
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PERSONAL COMPUTERS

THE NEW YORK TIMES SCIENCE TUESDAY, JULY 9, 1991

Some Sound Advice On Taking It Along

By PETER H. LEWIS

For anyone who has ever considered buying a laptop or notebook computer, or who has done so and is now trying to cope with all the little quirks that accompany portable computing, we enthusiastically recommend "The PC Magazine Guide to Notebook and Laptop Computers," by Bill Howard (\$29.95 from the Ziff-Davis Press, Berkeley, Calif.). It is the most enlightening, practical and comprehensive book on DOS-based portable computing we have seen.

The category of laptops and notebooks is one of the fastest-growing segments of the computer industry and perhaps the fastest-changing. New chip and manufacturing technologies have allowed portable PCs to get smaller and lighter while nearly matching the power of desktop systems. This guide helps the reader find the best laptop or notebook computer for his or her needs, at the best price.

It doesn't stop there, though. Laptop computer owners know that they have greater freedom to work on the road or at the beach, but they also quickly discover that a 7-pound laptop seems to weigh 20 by the end of a trip, that most hotels make it difficult to connect the portable PC to a phone line, that fax modems are treacherous things and that transferring files from the laptop to a desktop computer or a network is often harder than it

In short, little computers can cause big headaches. This book is better than aspirin. Tuck it into the flight bag; it is well worth the extra weight. Mr. Howard is executive editor of PC Magazine, which is known for its exhaustive reviews of computer

products and technologies. He also compiles a regular column on computer-related humor, and he manages to combine both his technical expertise and his droll wit in this book, as informative.

Most of the tips pay off in tangible ways. For example, computer dealers sell most of their machines to businesses, so an individual consumer must act businesslike to get the best deal. Mr. Howard includes a sample price-quote form that makes it easier to compare features and prices. There are how-to sections on communications, recommendations on must-have accessories and peripherals, advice on selecting software, a primer on how to manage phone lines at home and a troubleshooting guide, among other helpful tips.

Some of the tips are arcane. For example, if you're flying from New York to Texas with your portable computer, sit on the starboard (dark) side of the plane to get the best screen visibility. If you commute by train, remember that most cars have at least one AC power outlet that you can use instead of draining the battery, but watch out for power surges. If you stay at a higher-class hotel, you may have a better chance of finding an accessible phone jack in the bathroom, but be careful to keep the toilet seat down.

Although "The Guide to Notebook and Laptop Computers" is surprisingly thorough, there are some things that a reader will not find in its nearly 400 pages.

Most important, one will not find specific recommendations on brand names or models. Instead, Mr. Howard gives his readers the background to make their own evaluations, and, just as important, advice on how to

The guide comes with a 3.5-inch diskette that includes 18 utility programs that make laptop computing more convenient. Among the programs are one that highlights the active line of the laptop display, making it easier to read, and others that



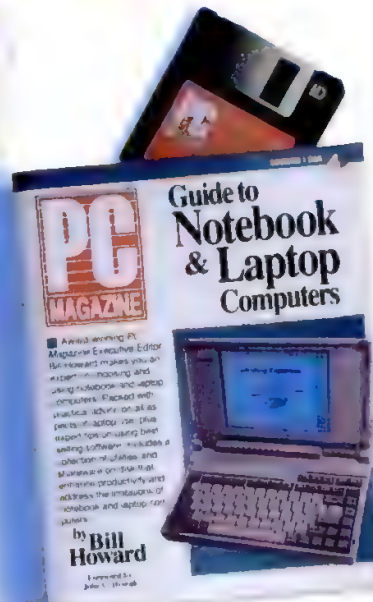
A guide to portables doesn't name brands, but helps you choose.

automate the retrieval of electronic mail on the MCI and Compuserve services.

evaluate the evaluations in other sources, including computer magazines, newspapers and newsletters.

Also, the guide assumes that the reader has a general familiarity with computers. Absolute beginners will find clear explanations of the various components of the computer system, but little in the way of basic PC instruction.

Nor will owners of the Apple Macintosh Portable, or any of its Frankensteinian clones, find any solace here; this is a DOS and Windows book only. Handheld and palmtop devices such as the Atari Portfolio, Sharp Wizard or Hewlett-Packard 95LX get little more than cursory coverage.



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The New York Times recently printed a review of *PC Magazine Guide to Notebook and Laptop Computers*. In it, writer Peter H. Lewis said "it is the most enlightening, practical and comprehensive book on DOS-based portable computing we have seen." If you want the best guide to Laptops and Notebooks, pick up the phone and order this book today. **1-800-688-0448**

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I want to research through a database a name and telephone number of a friend I have not seen in 45 years. I will pay for this service, but I do not know who maintains such a database. I have seen CDs advertised with business telephones, but not personal ones. Do you know where I can look for this information?

Ken Gossett
Inglewood, California



Not long ago, Lotus Development Corp. was planning to sell a database on CD-ROM that listed home addresses and phone numbers, and ran on Macintosh systems. But there was a tremendous public furor over the idea, and Lotus stopped production on the package.

However, the information is readily available to anyone with a modem and a CompuServe account (CompuServe Information Service, Columbus OH 43220). You can get account information by calling Customer Service at 800-848-8990 or 614-457-8650 between the hours of 8 A.M. to midnight E.S.T. The base fee for access is \$6 per hour at 300 bps; \$12.50 per hour at 1,200 and 2,400 bps; and \$22.50 per hour at 9,600 bps. There is an additional \$2 per month membership fee, and a major credit card (or the ability to do Electronic Funds Transfer) is required.

As one of its many services, CompuServe provides a gateway to the MetroNet *Phone*File* database. This is an on-line database that contains the name, address, phone number, and length of residence of over 80 million households in the U.S. It is an extra-cost service (\$15 per hour, or about \$0.25 per minute on top of the base CompuServe fee), but the

search is very fast, and the extra cost is generally nominal. When you're done with the search, a summary of the extra charges is presented.

Searches can be done by name and address, by telephone number, or by a last name with the ZIP code, city and/or state. MetroNet and CompuServe do not guarantee the accuracy of the information in the database, as it's gathered from public phone books or other public records. Of course, someone with an unlisted phone number generally won't be in the database.

*Phone*File* is available from 7 A.M. to 2 A.M. E.S.T. on weekdays, 7 A.M. to 11 P.M. E.S.T. Saturdays, and 10 A.M. to 8 P.M. Sundays, and can be reached by typing GO CIS:PHONEFILE at any CompuServe prompt.

APPLICATION FILE FORMATS

I am researching the development of an application that involves the reading and converting of files created by a number of different word processing packages, such as *WordPerfect*, *DisplayWrite* 4.0, etc. I am having a great deal of difficulty locating any documentation detailing the various structures and formats used by these packages. Could you direct me to pub-

- **PHONE-NUMBER DATABASES:** Is there a way to search for home names and phone numbers?
- **APPLICATION FILE FORMATS:** What books or reference guides exist for converting data files from one application to another?
- **MAPPING MEMORY:** How to find out which programs are taking up your RAM.
- **ORGANIZATION CHARTS:** Specialized software for creating organization charts.

lishers or reference libraries where this type of information would be available?

David Taylor
Scarborough, Ontario
Canada



You can avoid reinventing the wheel; *WordPerfect* already comes with its own CONVERT.EXE utility. This utility will convert documents between *WordPerfect* and *WordStar* 3.3, .DIF, IBM DCA (Revisable-Form-Text), and *MultiMate* Advantage II. It will also import *Microsoft Word* 4.0 and *DisplayWrite* documents into the *WordPerfect* format.

If this doesn't suffice, you'll find that there are a number of programmer's reference guides to the file formats used by PC-based applications packages. One recent book is *PC File Formats & Conversions for Developers*, by Ralf Kussmann (ISBN 1-55755-059-X; Abacus Software, Grand Rapids, Mich.; 616-698-0330; \$34.95). Mr. Kussmann's book covers a number of standard formats, including .DIF, SYLK, *dBASE IV*, *Microsoft Word* 4.0, and IBM DCA. A disk with sample routines and source code in Pascal is included.

The classic reference for file

conversions is Jeffrey Walden's *File Formats for Popular PC Software; A Programmer's Reference* (ISBN 0-471-83671-0; John Wiley & Sons, New York, N.Y.; 212-850-6000; \$24.95). Among the formats covered are *Lotus 1-2-3*, *Symphony*, *dBASE II* and *III*, .DIF, and both *WordStar* 3.3 and *WordStar* 2000. Mr. Walden also wrote a follow-up book called *More File Formats for Popular PC Software* (ISBN 0-471-85077-2; John Wiley & Sons; \$24.95); it includes *WordPerfect*, *Reflex*, *Rich-Text-Format*, and *Framework II*. Be aware that both of these books are old, and may not cover the latest versions of the software. A revised and expanded edition of the books, *File Formats II* (John Wiley & Sons; \$27.95), is due for release in September, 1991.

For information specific to word processing software, there's *Swap Word Processing Versions* (ISBN 0-471-01082-0; John Wiley & Sons; \$82.95), also by Mr. Walden. This large volume concentrates on word processing programs, including *WordPerfect*, various versions of *WordStar*, *MultiMate*, *DisplayWrite*, and IBM DCA format. All three books come with a disk of sample programs.

File formats can change with every new release of a software package; with the long lead times that exist in the book publishing industry, it takes a while before a revision is released that has information on the latest versions. Make sure that you examine these books before you purchase them, to make sure that they cover the file formats you wish to convert.

If you decide that writing your own software is too much work, look in the "Data Conversion" and "Disk Conversion" section of the Classified ads for a number of companies that provide the service on a disk-by-disk basis.

Advisor

MAPPING MEMORY

CHKDSK will tell me the number of bytes used in main memory. Is there some way to identify the files or programs that take up this memory?

Joseph Witt
Chapel Hill, North Carolina



Finding out the names and sizes of the TSRs and device drivers is possible, but only if you have DOS 3.0 or later. Earlier versions didn't store the program name when allocating the memory control block (MCB) for the TSR, so a memory mapping utility will only show the amount of memory used by each TSR.

A full discussion of how DOS keeps track of this information can be found in the June 12, 1990, Utilities column of *PC Magazine*. That column also presented a utility called MEMMAP, which will give you a list of all the TSRs in memory, as well as the environment space used by programs.

MEMMAP.ARC is available for downloading in Library 2 (PC-Mag Utils) of the PC MagNet Utilities/Tips forum. (Information on joining PC MagNet can be found on Page 10.)

DOS 4.01 and 5.0 come with the MEM utility, which provides a similar map of the programs resident in the system. You can upgrade to DOS 5.0 with a copy of Microsoft's MS-DOS 5.0 Upgrade, a \$99 program that looks for an existing version of DOS on your machine, and replaces it with DOS 5.0 to your hard disk.

MEM has three different modes. When used without any command line switches, it shows you the total amount of memory available and the total amount used. When used with the /P (for PROGRAM) switch, it shows the address of every program installed in memory. When used with the /D (for DEBUG) switch, it shows the addresses of every installed device driver and resident program. When used with the /C (for CLASSIFY) switch, it reveals the total amount of memory that each program is using.

MEM with the /C parameter may provide what you need, but



The MEM utility in DOS 5.0 generates a summary of how much conventional, extended, and XMS RAM in a PC is being used and how much is still available. When you use the /D switch with MEM, DOS will show you the memory locations where each program is loaded.

it's very little help in troubleshooting expanded and extended memory.

For a complete look at how the memory in your system is allocated, including device drivers and extended or expanded memory, get a copy of PMAP 2.03 (The Cove Software Group, Columbia, MD 21044; 301-992-9371). PMAP is copyrighted, but distributed for free, and is available in Library 1 (DOS Utilities) of the IBMSYS forum on CompuServe and on many bulletin board systems.

Another memory display utility is MAPMEM (TurboPower Software, Scotts Valley, CA 95066; 408-438-8608). MAPMEM itself doesn't show what device drivers you have loaded; however, it's distributed as part of a set of utilities called TSR-COM 2.9 (also copyrighted but free) that include DEVICE, which provides that function.

The TSR-COM utilities are not only let you see what's loaded in memory—they give you control over it. The programs MARK and RELEASE are designed to let you load and unload TSRs as needed. MARKNET and RELNET are also included, for unloading network drivers that don't work properly with the original versions. TSRC29.ZIP is available for download from Library 16 (Gen Utils) from the ZiffNet Utilities/Tips Forum, and it is also

available from many BBSs.

Most 286 and 386 memory-management programs, such as *Move'Em* and *386MAX* from Qualitas, and *GRAM* and *QEMM* from Quarterdeck, also come with utilities that display complete memory maps.

ORGANIZATION CHARTS

Are you aware of any organization chart packages? I have *Harvard Graphics* 2.3, but unfortunately the section on creating organization graphics is very limited. I cannot adjust the margins the way that I need them, am very limited to the size of the chart (how many levels),

etc. I would appreciate any information on packages that are available.

Linda Gallacher
Hamilton, Ontario, Canada

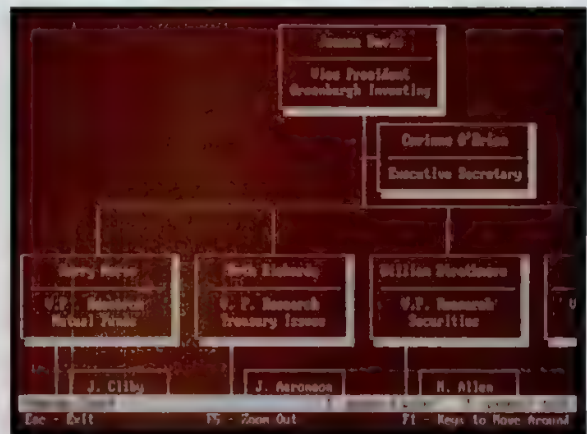


The built-in charting in *Harvard Graphics* (and many other general graphics programs) is handy for making quick and uncomplicated organization charts on a department or division level. However, it doesn't have the flexibility or features needed to create charts of an entire organization.

The most flexible organization chart program I know of is *OrgPlus Advanced* (Banner Blue Software, Fremont, CA 94537; 415-794-9152; \$295). *OrgPlus* is designed to produce a wide variety of organization charts, and supports up to 600 employees at 99 levels. You can either enter the information, and let the program design the chart for you, or customize the size and placement of the various boxes and lines on a graphics-based drawing screen using the arrow keys or a mouse. The charts can be printed on a dot matrix or HP LaserJet-compatible printer.

ASK THE ADVISOR

Send your questions to PC Advisor, One Park Avenue, New York, NY 10016; the MCI mailbox: PC MAGAZINE; or upload them to PC MagNet (see the instructions for joining on page 8 of this issue). Sorry, but we cannot send personal replies. ■



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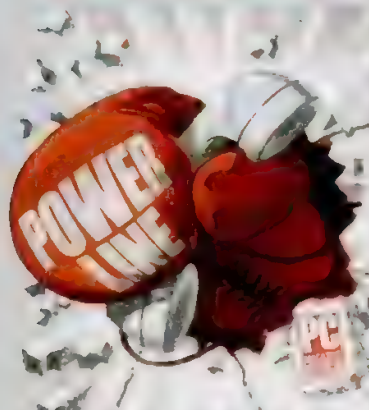
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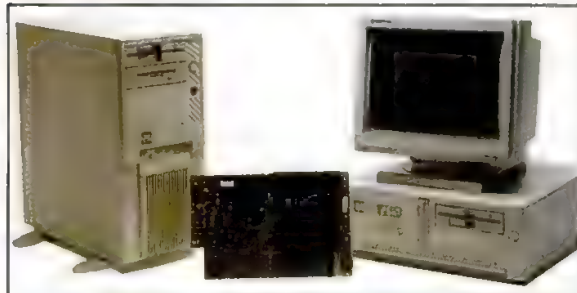
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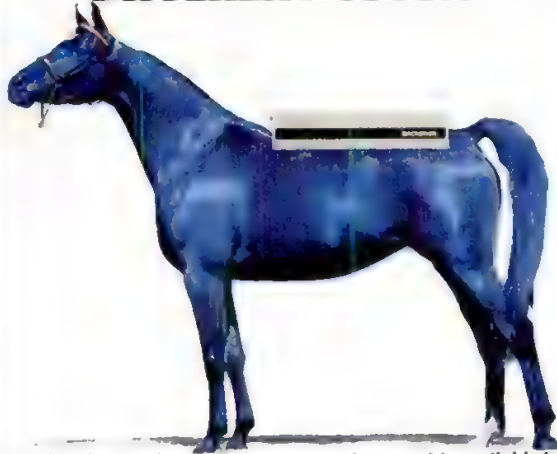
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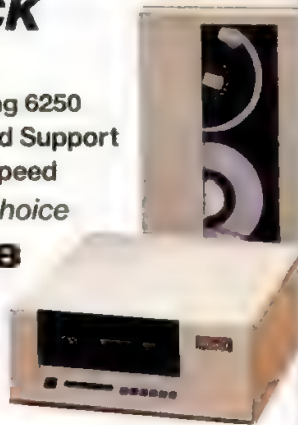
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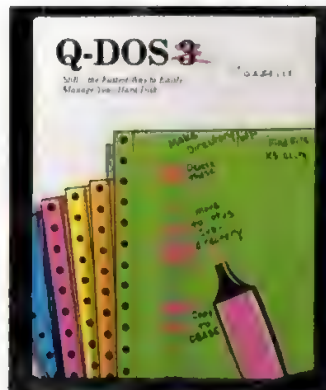
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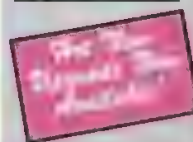
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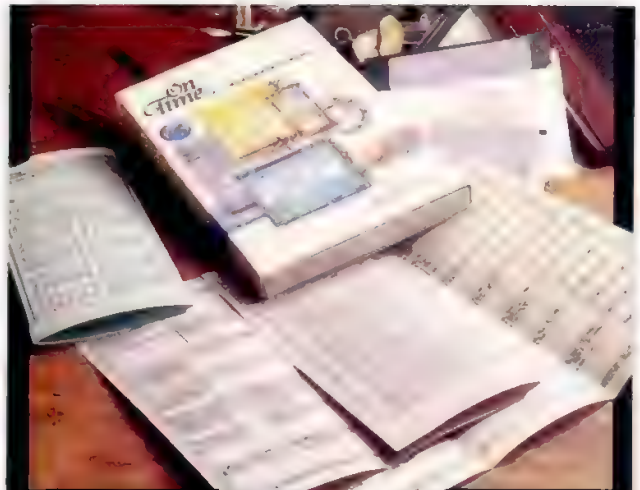
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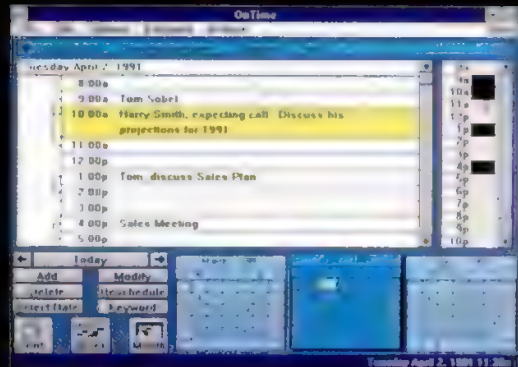
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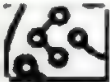
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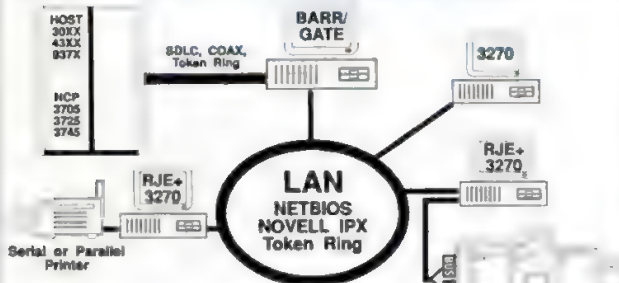


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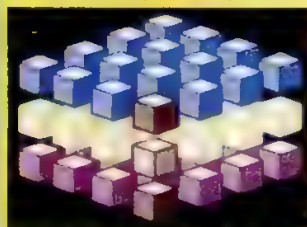
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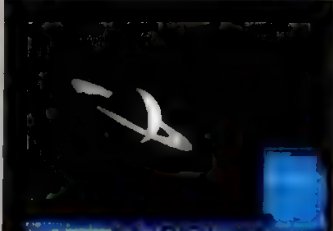
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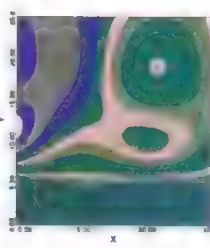
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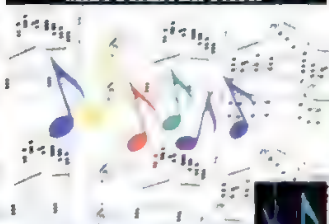
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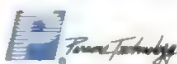


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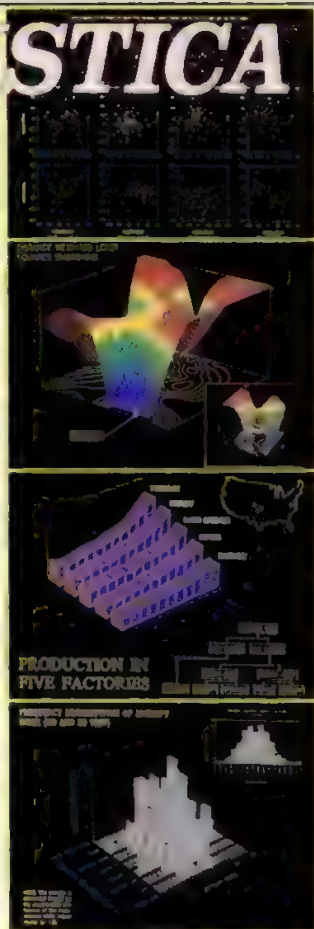
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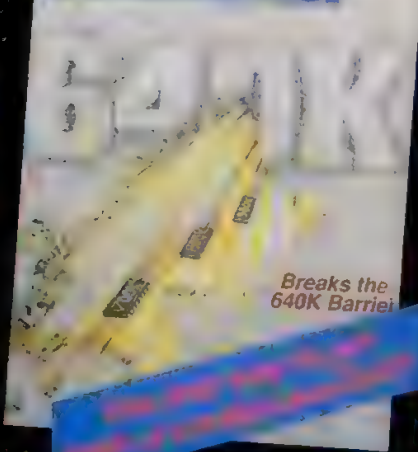
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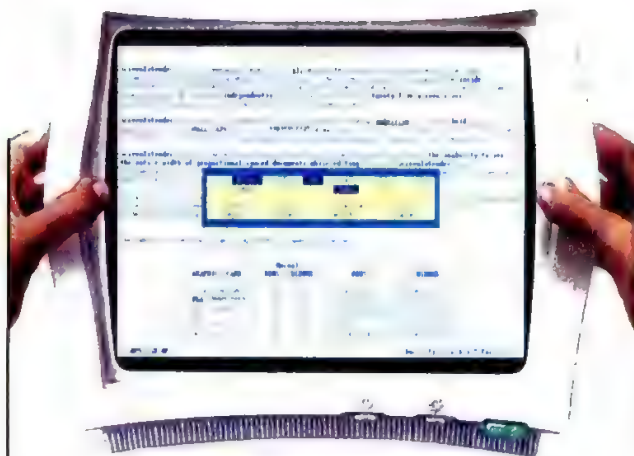
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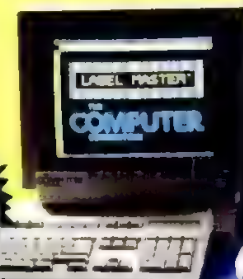
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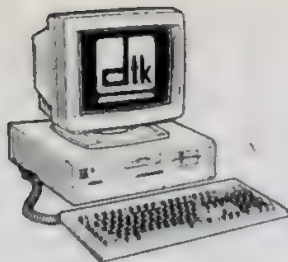
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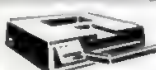
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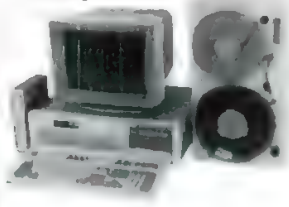
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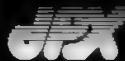
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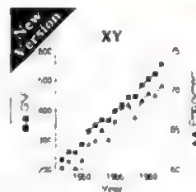
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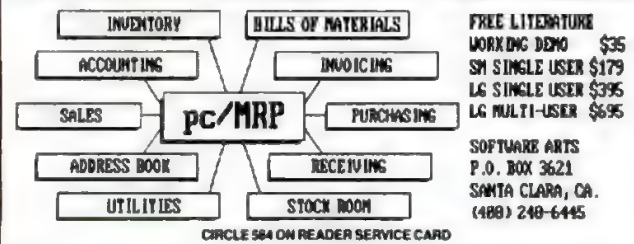
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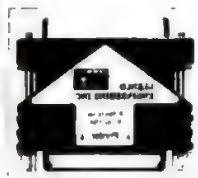
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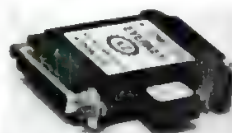


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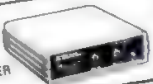
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CIRCLE 764 ON READER SERVICE CARD

PC Magazine's BusinessCard section is a forum for innovative, hard-to-find and low-cost PC products and services. Ads are listed by product category and include Reader Service numbers to allow fast, easy response.

RATES:

1 issue—\$600, 3 issues—\$550, 6 issues—\$510, 12 issues—\$480, 17 issues—\$460, 22 issues—\$450. Multiple-ad per issue rates also available. Prepayment must accompany each insertion. VISA/MC welcomed.

AD FORMAT:

PC Magazine will design and typeset each BusinessCard ad. Advertisers should furnish type-written copy. Ads include: 1) Headline (1 line, initial caps=30 characters max, all caps=25 characters max), 2) Descriptive copy (5 lines, 225 characters max), 3) Company name (same specifications as headline), and 4) Address and telephone number (2 lines, 40 characters per line). No logos, artwork or camera-ready ads. Publisher reserves the right to edit supplied copy to meet section specifications.

DEADLINES:

PC Magazine is published 22 times a year, (bimonthly except for July and August). The BusinessCard closing is approximately two months prior to issue date. Please send copy and payment to: PC Magazine BusinessCard, One Park Avenue, 3rd Floor, New York, NY 10016, ATT'N: Vickie Pinsky. For more information, call Vickie Pinsky at 800-825-4237 or 212-503-5120, FAX: 212-503-5860.

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- PC add-in board with transputer & 1MB mem
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- D)486/25/128kche 4mb 200mb 2fdd b/up \$3225
- E)486/33/64kche eisa 4mb 200mb 2fd b/up \$4295

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BusinessCard

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1. Do you work in a DP/MIS department?
01. ☐ Yes 02. ☐ No

2. Please indicate your company or organization's primary business activity: (Check one only)
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02. ☐ Manufacturer—Aerospace
03. ☐ Manufacturer—Other
04. ☐ Systems House
05. ☐ Computer Consultant
06. ☐ Computer Retailer/VAR/VAD Distributor
07. ☐ Communications
08. ☐ Finance/Banking/Insurance/Real Estate/Accounting
09. ☐ Education
10. ☐ Government—Federal
11. ☐ Government—Non-Federal
12. ☐ Research and Development
13. ☐ Data Processing/Computer Service
14. ☐ Health/Medical/Legal Service
15. ☐ Engineering/Architecture

16. Agriculture/Construction/Mining/Oil/Transportation/Utilities
17. ☐ Non-Computer Retailer/Distributor
18. ☐ Other Business or Service
99. ☐ Other

3. Please indicate your primary business function: (Check one only)
01. ☐ DP/MIS
02. ☐ Systems, Programming
03. ☐ Communications
04. ☐ Engineering
05. ☐ Res./Dev./Scientific
06. ☐ Accounting/Finance
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09. ☐ Operations
10. ☐ Production
11. ☐ Education/Training
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13. ☐ Medical/Legal
14. ☐ Admin./Mgmt.
99. ☐ Other

4. Is your company a reseller?
01. ☐ Yes 02. ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:
01. ☐ 10 or less 03. ☐ 25-99
02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office? (Check all that apply.)
01. ☐ Linked to mainframe
02. ☐ Linked to mini
03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply.)
01. ☐ IBM or Compatible PCs
02. ☐ IBM or Compatible Mainframes
03. ☐ IBM or Compatible Minis
04. ☐ Macintosh

8. Do you plan to buy any PC Products?
01. ☐ Now
02. ☐ In 4 to 6 months
03. ☐ In 7 to 12 months
04. ☐ No definite plans

9. Number of Employees in your entire company:
01. ☐ 25 or less
02. ☐ 26-99
03. ☐ 100-499
04. ☐ 500-999
05. ☐ 1000 or more

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3. The literature will be mailed to you from the advertiser free of charge.

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Coming Up

■ WRITERS' TOOLS

If you're not satisfied with the way you write, there are plenty of tools available to help you improve both the sentences you write and the way you write them. PC Magazine Labs evaluates 15 grammar checkers, thesauri, dictionaries, and spell-checkers. If you do any writing at all, one of these tools may make a great assistant.

■ DOS 5.0, THE ESSENTIAL UPGRADE?

With task switching, a user-friendly shell, and new memory management features, MS-DOS 5.0 atones for earlier sins of omission. How will the new version change your computing style? Contributing editor and DOS expert Jeff Proise examines all the issues that this long-awaited and important upgrade brings up.

■ PAGEMAKER 4.0

In this review, *PC Magazine* takes an in-depth look at Aldus's latest release of its popular desktop publishing program. We'll examine the new version's advanced type-control features and we'll show you how *PageMaker* competes with other programs on the market. We'll also decide if Version 4.0 is going to change desktop publishing forever—or not. Also be sure to read our sidebar on the problems of color separation on the PC.

■ SCALABLE FONTS

Have a message you want to get across? Why settle for one or two typefaces when you can purchase an entire library of scalable fonts? *PC Magazine* reviews nine libraries in the Type 1, Intellifont, and Speedo formats, but all you'll need is one to add some style to your substance.

DIGITAL Estrée
Franklin Gothic
Grizzly L&C
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■ SVGA GRAPHICS ADAPTERS

Since VESA (Video Electronics Standards Association) officially recommended the Super VGA standard, more and more graphics adapter manufacturers are entering the 800-by-600 resolution arena.

To help you successfully navigate this new video jungle, PC Labs tests over 20 Super VGA graphics cards. For business users, these boards provide all the right features: VGA and Super VGA, a 72-Hz refresh rate, 1MB of display memory, and a list price below \$700.

■ ISA TAKES ON EISA AND MCA

The Bus Wars are over, the players have gone back to their respective places, and IBM still dominates the Micro Channel. In our second look at the battle of the buses, *PC Magazine* examines the performance, availability, cost, and compatibility of EISA, ISA, and MCA PCs. Then we show you why you can still choose ISA for single-user workstations, but should move up to 32-bit architectures for your heavy-duty network applications.

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After Hours

Products for the Leisure Side of Personal Computing

Atlas Software: Around The World with Your PC

EDUCATION
by Barry Simon

What makes an atlas besides the maps? Is it a database or is it a book? New products from The Software Toolworks and Bureau Development take opposite tacks on this question.

The Software Toolworks' \$59.95 *World Atlas 2.0* includes over 200 maps and information in both textual and comparative data format; all this knowledge will cost you: The program takes almost 6MB of disk space. Version 2.0 of the companion *U.S. Atlas* is expected to be available by the time you read this; a \$109.95 bundle of both packages, on-disk or on CD-ROM, should also be available.

World Atlas has a lovely user interface. When you are looking at the map of any country, click-

ing on the name of a neighboring country will bring up the map for that country. Clicking on a red city name pops up a box with information about that city. Dialog boxes cannot be navigated with Tab or letter keys; instead, you need to move a pointer around the screen with the cursor keys. Needless to say, a mouse is highly recommended.

The program requires an EGA or VGA adapter; maps are displayed in 640-by-480 resolution, 16-color mode. In addition to the basic political maps for countries and regions, *World Atlas* has 18 topographical maps, including 3 of the oceans. Maps can be printed on an IBM Graphics Printer, LaserJet, DeskJet, or to disk in .PCX or .TIF format.

Besides the maps, *World Atlas* offers two kinds of data. A Text menu choice provides geographic, political, and economic information

for each country. The data can be quite extensive. We used the Philippines as a test: The textual material was over 20K.

You can also access data in graphical format—either bar graphs or colored maps. Graphs are available in over 200 categories including newsprint consumption, percentage of the population over 65, and barley production. The statistical maps, also in over 200 categories, can be shown for the world or any of 12 geographic regions.

The program has an alphabetical index, so for example, you can scroll to the Aare River and click to a map of Switzerland. However, when I loaded *World Atlas* with "only" 530K free, I tended to get an out of memory error when trying to use the alphabetical index or a few other program functions.

It's natural to ask how *World Atlas* compares with *PC Globe*, its major competitor. With Version 2.0, The Software Toolworks has leapfrogged past *PC Globe*. *PC Globe* has national anthems and flags, somewhat better organization of data (for example, comparative bar graphs

of population growth by country) and takes much less disk space (1.5MB versus 6MB). But *World Atlas* has a smoother mouse interface, topographical maps of oceans, and just oodles of other textual information. Its maps also have more geographic features.

Bureau Development, the publishing arm of the Bureau of Electronic Publishing (and a leading CD-ROM distrib-

EDUCATION

Three geography packages—two of them on CD-ROM—put the world at your fingertips.

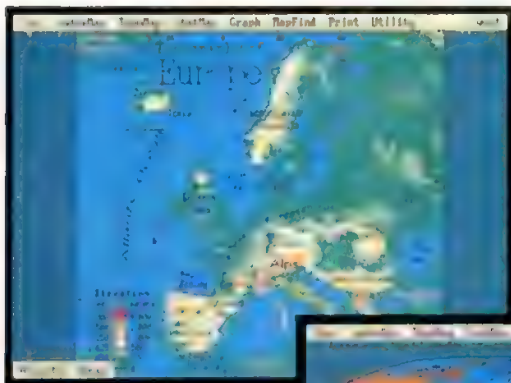
CD-ROM

Magazine Rack compiles the full text of popular periodicals

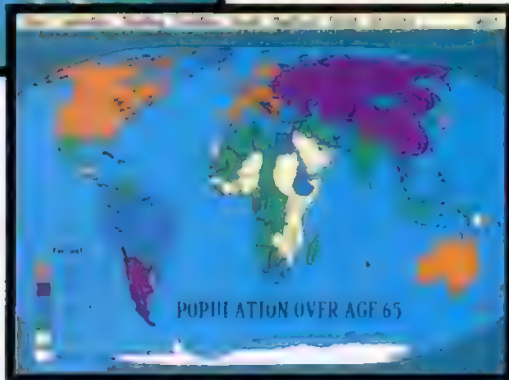
GAMES

Ever wonder if you could cut it as a surgeon? Try *Life and Death II* or *The Brain*

Arachnophobia
You saw the movie, now play the game



World Atlas (left) allows easy navigation with a mouse. The box indicates that clicking the mouse will call up the Atlantic Ocean map.



This breakdown by age is one of over 200 statistical maps that *World Atlas* can use to illustrate geographic data.

utor), has produced two different atlases on-disk: the \$99 *CIA World Factbook* and the \$495 *Countries of the World*. The latter is also available as part of a six-pack of disks for \$395, which through a marketing quirk costs less than the standalone version! The six-pack also includes CD-ROMs on U.S. history, the works of Shakespeare, Sherlock Holmes, movies, and a delightful *Birds of America*.

Both CD-ROM atlases from Bureau Development provide textual information without much in the way of data analysis. The *Countries of the World* disk is so chock full that national anthems for countries from A through the middle of C (and Canada in particular) had to be left out. An update of the standalone version is planned that will squeeze some data to make room.

CONTINUES

After Hours

PC Atlases

CONTINUED

CIA World Factbook has all of the anthems, but is otherwise a subset of what is found on the *Countries* disk.

Both CDs include textual information on each country. Surprisingly, the CD-ROMs have less information of this general factual type than does the disk-based *World Atlas*—12K versus 21K for the Philippines. Since both use information from the *CIA*, some of the text for geographic areas that appear on both *Countries of the World* and *World Atlas* is identical. But the *World Atlas* includes data on crimes, annual output by product, health information, and required travel documents.

The CDs also include full-color flag images and maps from Hammond's, a well-known publisher of paper-based atlases. Since these graphics are rendered in 256 colors, displaying them requires a VGA adapter. In fact, these images are really intended for 480-by-640 resolution, which, for that color depth, needs a Super VGA.

You can listen to national anthems if your CD-ROM drive includes audio output. But only snippets of each anthem are included, and they are often cut off in midphrase.

The *Countries Disk* goes beyond the *Factbook* by including long articles about most countries. These articles have huge volumes of data on history, geography, and culture, but they are sometimes dated. For example, the history entry for the Philippines is dated 1983—before the Aquino revolution—and dwells on the politics of the country under Marcos!

Both disks come with an efficient, powerful search engine, which allows Boolean searches. But the interface is not very smooth: There is no mouse support and menus have to be navigated with arrow keys.

In the end, I was disappointed in the CD-ROMs. They suffer from the defects of many current offerings in the CD-ROM world—high prices, poor inter-

faces, and lack of data analysis. But the sheer quantity of information coupled with the strong search capabilities will make the *Countries* disk attractive to some.

The PC atlas market is not yet mature. CD-ROMs are well suited to this niche, but we'll need to see a few improvements before the category really comes into its own. All such products should have a slick, flexible interface like *PC Atlas*, coupled with a wealth of data like that in *Countries*. There should also be support for sound



Countries of the World Includes long, detailed articles about many countries.

cards, and full-length versions of the national anthems. A shift to vector-based maps would allow more manipulation.

List Price: *World Atlas*, Version

2.0., \$59.95. **Requires:** 640K RAM, 6MB hard disk space. EGA or VGA graphics, DOS 3.0 or later. Mouse recommended. The Software Toolworks, 60 Leveroni Ct., Novato, CA 94949; 415-883-3000.

CIRCLE 547 ON READER SERVICE CARD

List Price: *CIA World Factbook*, \$99. *Countries of the World*, \$495. CD six-pack including *Countries*: \$395. **Requires:** 640K RAM, DOS 3.1 or later with MSCDEX, Version 2.0 or later. Super VGA board with 512K recommended. Bureau Development, 141 New Rd., Parsippany, NJ 07054; 201-808-2700.

CIRCLE 548 ON READER SERVICE CARD

Magazine Rack Puts 300 Periodicals on a Single CD

CD-ROM
by Don Trivette

The latest publication for the CD-ROM reference library is *Magazine Rack* from Ziff-Davis's Information Access Co., the world's leading supplier of periodical reference products.

Magazine Rack includes the full text of 100,000 articles taken from 300 periodicals published between December 1989 and December 1990. The company plans to issue annual editions with which the user can build a personal periodical library. The company has classified the contents of *MR* into four categories: general, health, business, and computers; they can be searched

Magazine Rack's search engine is somewhat clumsy, but it works quickly in retrieving stored information.



individually or globally.

When purchasing any type of CD-ROM reference, there are three issues to consider: the quality of the information, the quality of the retrieval software, and the price.

Although *Magazine Rack* contains articles from a great number of publications, many of them are obscure, special-interest magazines and newsletters like *Coal Outlook*, *Tire Review*, *Wines & Vines*, and *Tufts University Diet and Nutrition Letter*. On the other hand, these may be the very publications that your local library doesn't carry.

Glaringly absent from the health section are the *Journal of The American Medical Association* and the *British Medical Journal*; missing from the business magazines are titles like the *Harvard Business Review*, *Fortune*, *Forbes*, and *Business Week*;

the list of general publications is equally Spartan. The index does include few well-known magazines like *Car and Driver*, *Cosmopolitan*, *U.S. News & World Re-*

port, *The New Republic*, and *Stereo Review*, but they make up a small percentage of the contents.

Ease of retrieval is the second criteria by which a reference is judged. Although *MR*'s software is somewhat awkward—for example, hitting the Esc key doesn't always take you back one step—it is adequate for researching topics. One nice feature is that issue integrity is maintained so that you can page from one article to the next in the same magazine. Another timesaver is that *MR* can be run directly from the CD-ROM without having to install anything on a disk.

And the software goes about its work with pleasing dispatch—even while using a dynamic text decompression technique that packs more than 850,000,000 characters of information onto the disk.

The third consideration—price—is where *Magazine Rack* shines. At just \$89.95, it is affordable for both the home market and school libraries.

Two personal disappointments were a production glitch that eliminated many *PC Magazine* reviews (to be fixed in a forthcoming update) and the number of abstracted rather than full-text articles in the medical area. A company spokesman said it was felt that many medical articles are too technical for the lay reader, but I wish they had let the

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*Bob Hayes/Nordstrom, Inc.
Technology Architecture Manager*

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*Joseph Curtis/Con Edison
General Manager for Systems Engineering*

After Hours

Magazine Rack

CONTINUED

readers make that decision.

If you are building a CD-ROM reference library, here's your chance to add a whopping amount of material for very little money—about 2.5 cents per issue. Whether the specialized

nature of the publications will be an asset or a liability varies with the individual user.

List Price: *Magazine Rack*, \$89.95. **Requires:** 640K RAM, color monitor, Microsoft 2.1 CD-ROM extensions, CD-ROM drive, DOS 3.0 or later; mouse recommended. Information Access Co., 362 Lakeside Dr., Foster City, CA 94404; 800-227-8431.

CIRCLE 549 ON READER SERVICE CARD

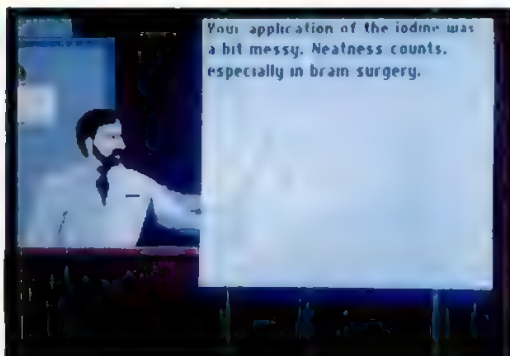
Life and Death II Tests Amateur Brain Surgeons



There's nothing like a little neurosurgery to really get your adrenalin pumping in the morning. If you're not easily nauseated, The Software Toolworks' *Life and Death II: The Brain* may be just what the doctor ordered. Like its gory predecessor—the popular *Life and Death*—it is not so much a game as a simulation; it's hard to imagine a mere game with hemorrhaging, irregular heartbeats, and severe brain injuries. But then, *LD2* isn't exactly a surgery simulation, either. If it were, you'd get more than a stern lecture for misdiagnosing a patient.

LD2 falls somewhere between games and simulations, offering just enough realism to make it an unwise choice for the weak of stomach. Toolworks makes no claims that the program is a teaching tool, but you'd be hard-pressed not to learn about the workings of the human ner-

If you botch a surgical procedure, you are sent back to med school for a refresher course in basic surgery.



vous system as you enjoy *LD2*.

While in *Life and Death* your goal was to perform successful abdominal surgery, the object here is to perform an absolutely perfect neurological operation. As in the first game, the process is as important as the outcome. Since you're a surgeon, proper medical procedures, attention to detail and diagnosis are vital to your success; they are also vital for your patient's survival.

Before you can try out your Trapper John, M.D. impersonation, you'll have to find someone to operate on, which isn't difficult. There's no shortage of patients in the neurology wing of Toolworks General, and you're the only doctor on call.

The first step is making a diagnosis. You'll need to put your patient through a series of physical exams on the eyes, arms, and legs. He or she could have anything from a migraine to a brain tumor, with a healthy dose of just plain old hypochondria thrown in. You'll also need to run the appropriate lab tests, and the first few times you run them, you'll find them quite amusing.

If you mess up a diagnosis, you'll get a stern talking to, and you'll have to go back to medical school. But you'll need to go to the classroom eventually, anyway. It's here that you'll learn all you need to know about slicing and dicing, drill-

ing, draining, and dissecting. If you need help during the diagnostic process, you can consult your handy neurology textbook, but once you enter the OR, you're on your own.

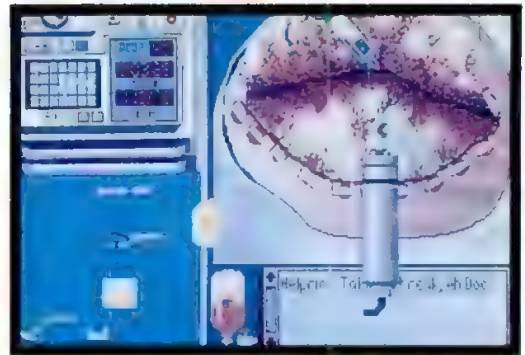
Performing surgery is not like cutting up salad. You need to follow detailed, step-by-step procedures and be prepared for any emergency. Patients do the damndest things, like hemorrhage to death after a simple scalp incision. You'll also need to know what to do when a patient's respiration rate rises, blood pressure plummets, or heart rate dips lower than the Dow Jones in a bear market.

Sure, it's complicated, but it's also fun. You'll make lots of mistakes along the way and send many patients to early graves, but once you get the hang of it, you'll be suctioning off subdural hematomas in your sleep. After you've logged enough knife time, you may want to opt for *LD2*'s intermediate, advanced, or nightmare mode.

Once you've gotten your scalpel wet, you'll have little patience for the diagnostic process or for the drug addicts and other whiners who don't really require your skillful ministrations. But this is part of *LD2*'s realism: Not everyone who winds up in the neurology wing needs to be treated at the end of a scalpel.

Few computer-generated environments are as realistic as the OR at Toolworks General. The heart monitor beeps, the drill sounds eerily like the dentist's, and the patient's scalp makes the most incredible ripping sound when you flap it back to reveal the skull. These digital sounds are graphic enough when heard through your PC's internal speaker; with an optional CMS Sound Blaster or Ad Lib card installed, you can also hear music and even more gruesomely realistic surgical sounds.

The VGA-quality graphics are every bit as realistic as they sound. The patients' flesh tones are thoughtfully rendered, skull



With its 256-color renderings of human innards, *Life and Death II* should be avoided by the faint of heart.

X rays are amazingly like the real thing, and the blood is a vibrant crimson hue. In EGA mode, the visuals are still impressive, but the flesh tones are orange and the skull X rays an unearthly shade of blue. Even the hypochondriacs look like they're not long for this earth (they're pumpkin-colored).

Design is clearly one of the game's strong suits. *LD2* is so easy to navigate through that you may never need to look at the documentation. You can find all the information you need on-screen. Just click on any area of the hospital you want to explore, including the cafeteria and the morgue, and you're in. And if you're totally confused, just see the receptionist. As is often the case, she knows more about what a surgeon should be doing than the surgeon does.

One touch of realism goes a little too far, though, and that's the inherent sexism of the medical profession. True, in real life the majority of surgeons are male, but Toolworks General is a mythical hospital, a place where female surgeons shouldn't be referred to by the head neurosurgeon as "he." This is just a minor quibble, but it's not what you'd expect from such a well-designed game.

List Price: *Life and Death II: The Brain*, \$49.95. **Requires:** 640K RAM, Tandy, EGA or VGA graphics adapter, DOS 2.0 or later. Hard disk, mouse or joystick, sound card recommended. The Software Toolworks, 60 Leveroni Ct., Novato, CA 94949; 415-883-3000.

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After Hours

Disney Follows Creepy Film With PC-Based Spider Hunt



Spiders, spiders everywhere and not a cricket in sight. That's the scenario you're faced with in Disney's *Arachnophobia*—one of last year's more entertaining comedy-horror films.

In Disney Software's *Arachnophobia*, the game, you play actor John Goodman's part—that of Delbert McClintock, exterminator extraordinaire. You must rid first one house and then another of deadly arachnids. Your arsenal of weapons includes a bug-bomb, aerosol spray, and combat boots (these boots were made for stomping). Spiders come creeping across the floor at you, jump from behind furniture, and drop silkily from overhead webs. Four

bites and you are out. Dead.

It's not enough that you have to squish and spray the little critters; each house is also infested with a throbbing, pulsating, disgusting egg case. You've got to destroy that too, and once you do, you get a directional clue as to the location of your ultimate objective—the queen spider.

I am a passably good arcade-game player, so I was surprised at the difficulty I had in killing these spiders. Nothing about this game is easy. I finally killed enough creepy-crawlies in one house to locate and destroy an egg case. It wasn't the house with the queen, so I started on a second house, where I succumbed. The queen is randomly placed in one of 15 houses. You may get lucky and find her quickly. I didn't.

There are two things that would make *Arachnophobia* better. In order to build player confidence and skill, the first level needs to be easier. It needs to be a lot easier. And even though the scenery changes from town to town, the action becomes repetitive. In the first town you work in houses, while in harder levels you work in buildings and even a graveyard, but you are still using the same tools and killing the same spiders.

VGA graphics and joystick support contribute to *Arachnophobia*'s good production values, as does support for the Sound Source, Disney's audio output device. I loved the movie—saw it twice—but fifty bucks seems a little overpriced for the game unless you love spiders or are

considering a career in the exterminator business. ■

List Price: *Arachnophobia*, \$49.95. **Requires:** 512K RAM (640K for Sound Source); CGA, EGA, or VGA graphics; hard disk recommended. Walt Disney Computer Software, 500 S. Buena Vista St., Burbank, CA 91521; 818-841-3326.

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—Radio Shack catalog, Christmas 1990



AT&T's answering machine, advertised by New York City-area electronics discounter Newmark & Lewis, claims printer-like attributes.

Amazing Facts I

According to Chemical Engineering (May 1990): "Quattro, another add-in program, is designed for error-checking of Lotus 1-2-3 files."

Amazing Facts II

The microprocessor as defined by *Family Handyman* magazine, March 1991:

"We now live in an age of microprocessors. Microprocessors are tiny packages of 'artificial intelligence' that shrink a truckload of old wiring circuits, tubes and other rugged electrical gadgets onto delicate silicon chips and boards the size of a sugar cube."



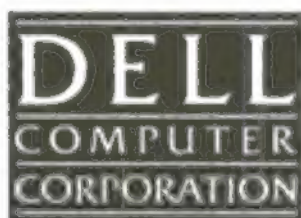
For the computer fanatic who has (almost) everything: BedWare Unlimited's SpreadSheets, bed linens in the form of green bar tractor-feed paper. (Actually, they're blue.) SpreadSheets are the creation of Scott Etheredge, marketing director of Storage Dimensions, and Carter Elliott, who runs a high-tech Silicon Valley PR agency. They're \$29.95 a twin set (two sheets, two pillowcases), \$34.95 for queen size from BedWare of Los Gatos, California (408-395-1622). They're also available at the Boston Computer Museum. ARF? finds SpreadSheets amusing (but don't quit your day jobs just yet, fellows) and fears for the impending onslaught of other computer oddities from PR-hungry entrepreneurs (please, no more chocolate PCs or floppy disks.)

If your entry is used in Abort, Retry, Fail? we'll send you \$50 and a PC Magazine T-shirt. Caution: In case of multiple entries, the postmark date, neatness and completeness of entry are considered. Winners this issue: Bjarne Berge (Quattro), Antonio A. Lozada (optional interference), Marc Klein (AT&T answering machine), Arra Yeghiayan (microprocessor).

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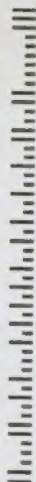
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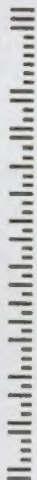
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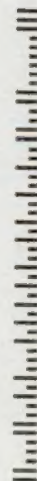
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